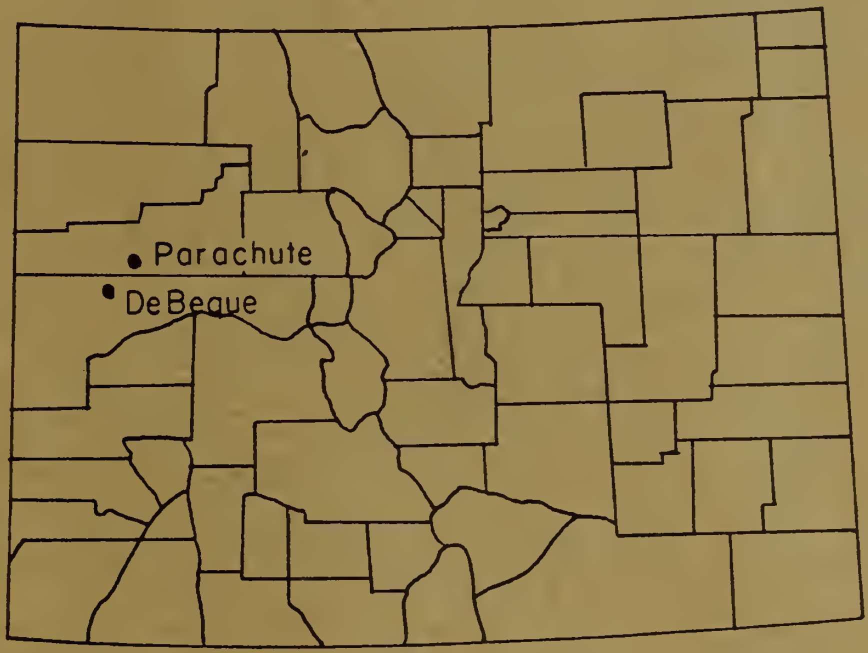
FLOOD PLAIN MANAGEMENT STUDY

PARACHUTE CREEK IN THE VICINITY OF PARACHUTE, CO. AND ROAN CREEK IN THE VICINITY OF DEBEQUE, CO.



Prepared by the
U.S. Department of Agriculture
Soil Conservation Service
Denver, Colorado
in cooperation with the
Colorado Water Conservation Board
Towns of Parachute and DeBeque
Garfield and Mesa Counties, Colorado

August 1985

PREFACE

This report includes information on the flood hazard areas along Parachute Creek in the vicinity of Parachute Colorado and Roan Creek in the Vicinity of DeBeque, Colorado.

Because of the potential flood damages, detailed flood hazard studies have been recognized as an essential item in guiding the use of flood plains. The purpose of this report is to provide adequate mapping and data for implementing flood plain management programs.

Included in the report are information on past floods, flood potential, maps, profiles, cross sections, discharge data, and recommendations for reducing potential flood damages.

The Soil Conservation Service conducted the technical studies and prepared the report. These services were carried out in accordance with the Plan of Work of December 1982.

The assistance and cooperation provided by the Colorado Water Conservation Board, Towns of DeBeque and Parachute, and Garfield and Mesa Counties are appreciated and gratefully acknowledge. Financial assistance provided by the Board, the Towns and Counties included funds for photogrammetric maps, and cross section data. Three sheets of mapping (sheets 12, 13, 14) provided by Getty Oil Company were used along the upper reach of Roan Creek. The use of these maps is greatly appreciated.

The survey, hydrologic, hydraulic, and other pertinent data and computations are on file with the U.S. Department of Agriculture, Soil Conservation Service, 2490 West 26th Avenue, Denver, Colorado 80217,

telephone (303) 964-0295. Additional copies of this report may be obtained from the Colorado Water Conservation Board, or the Soil Conservation Service.

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COLORADO

INTRODUCTION

This flood plain management report was prepared by the U.S. Department of Agriculture, Soil Conservation Service, in cooperation with the Colorado Water Conservation Board, Towns of Parachute and DeBeque, Garfield and Mesa Counties. Interpretations of the flood plain management study and recommendations to reduce damages are included; however, it is beyond the scope of this report to provide specific proposals or plans to rectify the flooding problems.

Objectives

The objective of this study is to provide flood plain management information and mapping to the towns of Parachute and DeBeque, Garfield and Mesa Counties for use in implementing flood plain management programs which will minimize potential flood losses. Included in the report are engineering and hydrologic data which will facilitate the development of a flood plain management plan, road and bridge plans and design, and non-structural and/or structural flood control measures (if needed).

Authority

This study was requested by the towns of Parachute and DeBeque, and Garfield and Mesa Counties through the Colorado Water Conservation Board (CWCB). The CWCB is the state coordinator for all flood plain information studies and is responsible for setting priorities and scheduling these studies. The CWCB and the Soil Conservation Service entered into a Joint Coordination Agreement for flood hazard analyses in January 1972

(revised November 1978). The Plan of Work for the Study was prepared in March, 1982.

Section 37-60-106(1)(c), Colorado Revised Statutes, authorizes the Colorado Water Conservation Board "to designate and approve storm or floodwater runoff channels or basins, and to make such designations available to legislative bodies of cities and incorporated towns, to county planning commissions, and to boards of adjustment of cities, incorporated towns, and counties of this state." The Board provides assistance to local governments in development and adoption of effective floodplain ordinances. In addition, the Board will provide technical assistance to local entities during the performance of floodplain information studies within Colorado. Presently, financial assistance for the performance of floodplain studies is no longer available from the board.

Section 30-28-111 for county governments and Section 31-23-201 for municipal governments of the Colorado Revised Statutes, states: The cities, incorporated towns, and counties within the study area may provide zoning regulations: "...to establish, regulate, restrict, and limit such uses on or along any storm or floodwater runoff channel or basin that has been designated and approved by the Colorado Water Conservation Board, in order to lessen or avoid the hazards to persons and damage to property resulting from the accumulation of storm or floodwaters..."

Therefore, upon official approval of this report by the Colorado Water Conservation Board, the areas described as being inundated by the

100-year flood can be designated as flood hazard areas and their use regulated accordingly by the local agencies.

Flood plain management studies are carried out by the Soil Conservation Service as an outgrowth of the recommendations in A Report by the Task Force on Federal Flood Control Policy, House Document No. 465 (89th Congress, August 10, 1966), especially Recommendation 9(c), Regulation of Land Use, which recommended the preparation of preliminary reports for guidance in those areas where assistance is needed before a full flood plain information report can be prepared or were a full report is not scheduled.

Authority for funding flood plain management studies is provided by Section 6 of Public Law 83-566, which authorizes the U.S. Department of Agriculture to cooperate with other federal, state and local agencies to make investigations and surveys of the watersheds and rivers and other waterways as a basis for the development of coordinated programs. In carrying out flood plain management studies, the Soil Conservation Service is being responsive to Executive Order 11988, entitled "Flood Plain Management", and Executive Order 11990, entitled "Protection of Wetlands" (both effective May 24, 1977).

DESCRIPTION OF THE STUDY AREA

Basin Characteristics

This study involves the Roan Creek Basin (507.5 square miles) and Parachute Creek Basin (200 square miles). They are adjacent drainages, both flowing in a southeasterly direction into the main stem of the Colorado River.

The Basins headwaters originate on the Roan Plateau at elevations near 8800 ft. The Roan Creek Channel empties into the Colorado River at an elevation of about 4900 ft. near the town of Debeque. Parachute Creek flows into the Colorado River upstream from Roan Creek at an elevation of 5050 ft., near the town of Parachute.

The topography is primarily plateau-like table land deeply cut by watercourses which form steep canyons. The region is rich in coal and oil shale deposits.

The climate of the area is influenced by Pacific storm systems that move from west to east. The nearest national weather station, representative of the lower part of the basin, is at Rifle. The mean annual temperature at Rifle is 47°F with about 109 days of growing season between the spring and fall 32°F frost occurrences. The mean annual precipitation at Rifle is just over 11 inches. This increases to about 20–25 inches at the higher elevations. Wintertime precipitation is usually snow from late October to early April.

The soils include Mollisols at the higher elevations in the Upper Basin and Aridisols and Entisols in the lower part of the Basin. Fluvents are dominant adjacent to stream channels. The geologic formations include the Tertiary Green River, which contains oil shale deposits, and the Wasatch.

The higher ridges have conifer and aspen while lower areas have juniper and pinyon interspersed with sagebrush. Willows and cottonwoods grow along the streams. There is also some irrigated cropland at lower elevations along the streams.

The towns of Parachute, on Parachute Creek, and Debeque, on Roan Creek, are the only communities in the basins. They are situated adjacent to the main channels near their confluences with the Colorado River.

Study Limits

The area of study includes the flood plain of Parachute Creek from its confluence with the Colorado River upstream to the west edge of Section 28, T6S, R96W (7.5 miles) and the flood plain of Roan Creek from its confluence with the Colorado River upstream to the Garfield County Line (5.2 miles).

The towns of Parachute and Debeque are within the study area and parts of each community are within the flood plains.

Natural and beneficial Flood Plain Values

The flood plains along Roan and Parachute Creeks contain areas of irrigated pasture and hayland interspersed with areas of natural vegetation. Along the channel, the vegetation consists of a variety of forbs, grasses, sedges and rushes interspersed with cottonwoods, willows and siberian elm. The meandering channel, passing through cropped farmland, provides a diversity in landscape.

The lush vegetation in the flood plains makes a vivid contrast to the barren hills surrounding the general area. This diversity enhances the visual aestheties and wildlife habitat values in the area.

These flood plains support a variety of wildlife species such as: mule deer, coyote, cottontail, red-winged blackbird, blue herron, song

sparrow, black-headed grosbeak, red-tailed hawk, golden eagle, bald eagle, Canada goose, mallard and many other species of wildlife. These riparian areas are very important in the arid regions of Colorado. The proximity to water and robust vegetation supported by the water regime attract more species of wildlife to this habitat type than any other in western Colorado.

RELATED FLOOD STUDIES

The Morrison-Knudsen Company, Inc. carried out a study to provide Chevron Shale Oil Company with a preliminary 100-year flood boundary map on Roan Creek. It was intended as a guide for DeBeque's expansion plans. The report is dated July 1981 titled "Clear Creek Shale Oil Project

The Corps of Engineers, Sacramento District, published an Internal Official Memorandum Report "Flood Insurance Study Hydrology, Garfield and Mesa Counties, Colorado" dated November 1975. This was a relatively broad study that included drainage area vs. cubic feet per second per square mile envelope curves. The curves were intended for estimating peak discharges on streams in Garfield and Mesa Counties, Colorado, apparently for flood insurance purposes.

FLOOD HISTORY

Major flooding along Parachute Creek and Roan Creek is caused by rapid melting of the mountain snowpack during late May to early July as well as summer rainstorms. There is also the potential for flooding as a result of rainfall occurring on melting snow. The snowmelt floods are characterized by moderate peaks, large volumes, and long durations. The summer floods have characteristics of high peaks, and short flow durations.

The most recent damaging flood occurred during the end of May, 1983 on Roan Creek. It resulted from the melting of an unusually deep snowpack. The above average spring runoff caused concern all along the Colorado River, including the large Glen Canyon Dam. People in the area of Roan Creek reported that water started rising about May 15 and remained at a high stage until June 6.

About 10 families along the Creek were affected. Irrigation systems were washed out making it impossible for local ranchers to irrigate. Approximately 200 acres of irrigated pasture and hayland were damaged with debris, sediment, scarring, and streambank erosion. About 1/2 of the total crop production in the Roan Creek Drainage was damaged, along with 12 miles of county road and 3 bridges. Total damages were estimated at over 1 million dollars. Streamgages on Roan Creek were discontinued in 1982 therefore, the peak discharge for this flood was not determined.

Other events of significance on Roan Creek include:

May 11, 1980	- discharge = 2,020 cfs
May 19, 1979	- discharge = 1,190 cfs
Sep 19, 1972	- discharge = 1,900 cfs
Aug 20, 1971	- discharge = 1,000 cfs
May 26, 1967	- discharge = 1,220 cfs
May 21, 1922	- discharge = 1,110 cfs

Significant flood events on Parachute Creek include:

May 18, 1979	- discharge = 944 cfs
Aug 19, 1977	- discharge = 2,310 cfs
Jul 31, 1976	- discharge = 2,600 cfs
May 5, 1952	- discharge = 912 cfs
May 20, 1922	- discharge = 795 cfs

Streamflow records are far from complete on Parachute Creek and Roan Creek, therefore a number of other flood events no doubt have occurred without being recorded.

INVESTIGATIONS AND ANALYSIS

Interpretation and Use of Report

A. Frequency and Discharge

The 10-, 50-, 100-, and 500-year flood events are used as the flood frequencies for this flood plain analysis. Thus the data developed in this report will be compatible not only for regulation purposes, and H.B. 1041 designation but also for Federal Insurance Administration flood insurance rate studies.

These various flood events have an average occurrence of once in the number of years as indicated. For example, the 100-year flood occurs, on the average, once in a 100 year period, and has a one percent chance of being equaled or exceeded in any given year.

The particular uses for the various flood events in addition to those stated above are as follows:

10-Year and 50-Year Flood Events

Information regarding these lower frequency floods is especially useful for future engineering studies and land use planning purposes related to minor road systems, minor channel improvements, the location of parks and recreational facilities, agricultural lands, and appurtenant structures. The use of the lower frequencey floods may be considered in planning flood prevention projects to protect agricultural areas, or other property where risk to life is not a factor.

100-Year Flood Event

The 100-year flood event may be used in lieu of lower frequencies for engineering design purposes where greater security from structure failure is desired.

However, the most important use of the 100-year flood event lies in flood plain management and land use planning as set forth in the state statutes. The State of Colorado considers the 100-year frequency flood as the flood event to be used in designing and protecting structures and dwellings for human occupation. Therefore, all flood plain regulations are based upon the 100-year flood.

500-Year Flood Event

The 500-year flood event is useful in making the public aware that floods larger than the 100-year flood can and do occur. Just because a person is living above the 100-year flood boundary does not mean that he is completely safe from flooding. The 500-year flood event can also be used for regulating high risk developments within the flood plain such as nuclear power plants, or the storage or manufacture of toxic or explosive materials.

B. Flood Elevation

The included exhibits and tables display study results. Flood crest elevations for the 10-, 50-, 100-, and 500-year floods, as determined at each cross section, may be found in Table 1 "Flood Frequency-Elevation and Discharge Data". The Cross Section Exhibits, B-1 through B-8, show a graphical representation of high water elevations at typical valley cross sections. Water surface elevations computed at each cross section were used to prepare flood profiles, exhibits A-1 through A-16, which show the streambed elevation in relation to high water elevations for the 10-year 50-year, 100-year, and 500-year frequency floods.

The flood profiles may be used in areas where controversy arises over the 100-year flood boundary shown on the Flood Plain Maps. Since the flood profile exhibits give the water surface elevation at a specific

point on the reference line, the high water elevations can be surveyed on the ground to alleviate any discrepancies on the base map.

C. Flooded Areas

Flood plain maps, sheets 1 through 14, show the boundary of the 100-year and 500-year flood plains. The flood plain boundaries were plotted from the flood profiles by determining channel stationing of flood contours at the same interval as the topographic maps. Flood contours, shown as wiggly lines, extend perpendicular to the direction of flow and intersect the ground at the edge of the flood plain.

The areas included within the flood line boundaries are about 550 acres for the 100-year frequency and 730 acres for the 500-year.

Upon official approval of this report by the Colorado Water Conservation Board, the area outlined by the 100-year flood boundary may be regulated accordingly by the local officials.

D. Floodway

Encroachments on flood plains, such as artificial fill, can reduce the areal extent of a flood plain if provisions are made for increased flood heights. As an alternative to the present flooding situation, a possible floodway with flood plain encroachment was analyzed in this study. This was simply a hydraulic analysis in which the flood plain was theoretically modified to contain flooding within selected encroachment boundaries. The resulting effects on flood elevations are shown in an Appendix separate from this report.

Hydrology

Tributaries to the Colorado River in the vicinity of DeBeque to Glenwood Springs, Colorado are streams that flood from snowmelt as well as from summer rain. The intent of this analysis was to separate the annual peak discharges into rainfall events and snowmelt events. Separate frequency curves should be combined statistically to produce a final discharge frequency curve. There was insufficient streamflow data of rainfall flood events to accomplish this, therefore the SCS TR-20 computer program was used to simulate rainfall flood peaks. The model was used on 16 watersheds of varying sizes. A regional curve of drainage area vs. peak discharge and frequency was developed for rainfall flooding. The TR-20 analysis included the standard SCS Type II (24 hour) rainfall distribution and curve numbers for an average antecedent soil moisture condition (AMC-II). The discharge vs. drainage area data from this analysis were plotted, and a regression line computed for several frequencies.

A regional curve was developed for snowmelt flood events using streamgage data from 8 streamgages in the area. The Log Pearson III frequency distribution (as defined in WRC Bulletin 17-B) was used with a regional skew weighted with each computed station skew. The data was plotted and frequency lines drawn.

The two regional discharge frequency-drainage area curves (rainfall and snowmelt) were combined using a standard probability equation:

$$P(comb)=P(snow)+P(rain)-(P(snow)xP(rain)).$$

This combined regional curve is proposed for studies along the Colorado River Tributaries in the vicinity of Debeque to Glenwood Springs, Colorado.

Hydraulics

The U.S. Army Engineers HEC-2 computer program was used to perform water surface profile computations. Several bridges and culverts exist along the channels through the study reach. Dimensions for these road crossings were determined from field investigations and the data was integrated into appropriate cross section data.

Cross section data, and reach length information were obtained from photogrammetric maps. Maps were prepared especially for this study, except for the upper reach of Roan Creek. Available maps provided by Getty Oil Company were used for this upper reach. The Getty Oil maps have 5.0 ft. contour intervals whereas the other maps have 2.0 ft. intervals.

Hydraulic roughness coefficients (n-values) were determined from field investigations and documented with photographs (in technical addendum). A tabulation of roughness coefficients is included in the technical addendum for various locations along the study reach.

Water surface profiles, typical cross sections and maps showing the 100-year and 500-year flood lines are shown on included exhibits and flood plain maps. Table 1 shows computed flood elevations at specific cross sections.

Flood lines were located on the maps by transferring flood elevations (at map contour intervals) from plotted profiles (from HEC-2) to the maps, using stationing along the main channel as the location reference. These points were connected and smoothed to create the map flood lines.

Significant divided flow occurs at the railroad crossing southwest of Parachute on Parachute Creek. This divided flow occurs when restricted flow from the railroad bridge overtops the tracks for the 100-year and

500-year frequency discharges. This overflow moves in a northeast direction away from the channel of Parachute Creek. An approximate location of the path of this overflow is shown on included flood plain maps. Flood profiles for this segment of flow are now shown in this report.

FLOOD PLAIN MANAGEMENT

Potential flood damages to existing development and possible loss of life can be alleviated or lessened through non-structural and structural methods.

Non-structural methods include: flood plain regulations, land treatment, flood warning and forecasting systems, flood insurance, flood proofing, and flood fighting and emergency evacuations.

Local Regulations

The need to minimize property damage due to flooding has been recognized by planners and local community officials. Subdividers and developers are required to submit proposed storm drainage plans to the planning commission for approval. In the past, drainage plans have been prepared signularly or on a plat-by-plat basis. Information contained in this report will be useful in developing a master drainage plan for the study area. This report provides the outline of flood hazard areas on large scale maps specifically for this purpose.

The city may provide zoning regulations...

> ..."to establish, regulate, restrict, and limit such uses on or along any storm or floodwater runoff channel or basin, as such storm or floodwater runoff channel or basin has been designated and approved by the Colorado Water Conservation Board, in order to lessen or avoid the hazards to persons and damage to property resulting from the accumulation of storm or floodwaters"...

as stated in Section 30-28-111 for county governments and Sections 31-23-201 for municipal governments of the Colorado Revised Statutes 1973.

Colorado Natural Hazard Area Regulations

In 1974, the Colorado General Assembly passed House Bill 1041, a bill "concerning land use, and providing for identification, designation, and administration of areas and activities of State interest,..." (H.B. 1041, Title 24, Article 65.1, CRS, as amended). Areas of State interest include natural hazard areas, or those areas that are "so adverse to past, current, or foreseeable construction or land use as to constitute a significant hazard to public health and safety or to property." Flood plains are natural hazard areas.

With reference to the administration of natural hazard areas, section 24-65.1-202(2)(a) of the Act provides: Flood plains shall be administered so as to minimize significant hazard to public health and safety or to property; open space activities shall be encouraged; structures shall be designed in terms of use and hazards; disposal sites and systems shall be protected from inundation by floodwaters; and activities shall be discouraged which, in time of flooding, would create significant hazards to public health and safety or to property.

The Act further provides that after promulgation of guidelines for land use in natural hazard areas..., the natural hazard areas shall be administered by local government in a manner which is consistent with the guidelines for land use in each of the natural hazard areas.

Colorado Water Conservation Board Designations

Concerning the designations of flood plain, the Colorado Water Conservation Board is charged with the primary responsibility for:

1. Making recommendations to local governments and the Colorado Land Use Commission.
2. Providing technical assistance to local governments.

The Board's power and duty is ...

> ..."to devise and formulate methods, means and plans for bringing about the greater utilization of the waters of the state and prevention of flood damages therefrom, and to designate and approve storm or floodwater runoff channels or basins, and to make such designations available to legislative bodies of cities and incorporated towns, to county planning commissions, and to boards of adjustment of cities, incorporated towns, and counties of this state"...

as stated in Section 37-60-106 (1) (c) of the Colorado Revised Statutes

Upon review and approval of this report, the Colorado Water Conservation Board will designate and approve as flood plain areas those areas inundated by the 100-year flood as described by the floodwater surface elevations and profiles in this report. The use of the designated flood plain areas may then be regulated by the local government.

Model Regulations

In the model flood plain regulations, adopted by the Colorado Water Conservation Board, the statement of purpose is to promote the public health, safety, and general welfare, and minimize flood hazards and losses by provisions designed to:

1. Promote sound planning and land use, and permit only such uses within flood plains that will not endanger life, health, and public safety or property in times of flooding.
2. Protect the public from avoidable financial expenditures for flood control projects, flood relief measures, and the repair and restoration of damaged public facilities.
3. Prevent avoidable interruption of business and commerce;
4. Minimize victimization of unwary home and land purchasers; and

5. Facilitate the administration of flood hazard areas by establishing requirements that must be met before use or development is permitted.

The Board's model flood plain regulations offer two options for management of the 100-year flood plain. These are the Hazard Area Concept and the Floodway Concept.

The Hazard Area concept defines the areas of the flood plain in which waters of the 100-year flood attain a maximum depth greater than one and one-half feet as a high hazard areas, and a depth less than this as a low hazard area.

The Board recommends that no basements should be allowed for structures located within the low hazard area and all habitable living quarters (first floors) should be constructed a minimum of one foot above the 100-year floodwater surface elevations. Development is prohibited in high hazard areas.

The Floodway concept defines the channel of a stream and adjacent flood plain areas that must be kept free of development in order to safely pass the 100-year flood with a minimal rise in the water surface elevation. The rise must be no more than one foot to meet federal and state standards.

There are several methods used in floodway computations. One such theoretical method is computed on the basis of equal conveyance reductions for each side of the flood plain. A rise concept floodway was computed during this study. Because of the large amount of computional data, floodway information and data are included in appendix II separate to this report. Data are in tabular form and include floodways widths,

cross sectional flow area, and average velocities. Computations are for an increase in rise of water surface elevations in 0.5' increments from 0.0' to 1.5' above the 100-year flood.

Flood Insurance

The National Flood Insurance Act of 1968 (Title XIII of the Housing and Urban development Act, P.L. 90-448) recognized the necessity for flood plain management. This Act makes federally subsidized insurance available to citizens in communities that adopt regulations controlling future developments of their flood plain. In respect to encroachment on the flood plain, the regulations require:

New residential construction or substantial improvement of existing homes must have the lowest floor level above the elevation of the 100-year flood.

Non-residential construction must meet the same standard or be flood proofed to that level.

The 1968 Act benefits owners of structures already in the flood-prone areas by providing insurance coverage that had been unavailable through private companies. The Act created a cooperative program of insurance against flood damage by the private flood insurance industry and the federal government.

The amount of coverage available and the premium rate varies considerably depending on property location within the flood plain and the property value. All property owners shown in this study to be within areas subject to flooding should consider the purchase of flood insurance.

Additional information on the flood Insurance Program is available from local insurance agents or brokers and the:
Federal Emergency Management Agency

Division of Insurance and Mitigation

Building 710

Denver Federal Center

Denver, Colorado 80225

Telephone 235-4830

The National Flood Insurance Program uses the floodway concept in its' rate studies for communities participating in its' regular programs.

Flood Warning and Flood Forecasting Systems

The National Oceanic and Atmospheric Administration (NOAA) through its' National Weather Service (NWS), maintains year-around surveillance of weather and flood conditions. Daily weather forecasts are issued through the NWS and disseminated by radio and television stations. A general alert to the danger of flash flooding is one of the services provided by the National Weather Service.

Evacuation Plan

An "Emergency Evacuation and Operations Plan" would provide for alerting the public of potential flooding, and coordinating community and county services during an emergency. Plan implementation during the time of an emergency requires cooperation of the general public as well as local officials. This is especially important for flood fighting, evacuation, and rescue operations. Communication is extremely important during flood alerts. Warnings issued through the National Weather 21

Service are disseminated by radio to state and local officials.

Structural Flood Control Measures

Under present conditions, bridges along the lower reaches of Parachute Creek and Roan Creek restrict flow and contribute to out-of-channel flooding. The most critical constriction is located at cross section 235 (Denver and Rio Grande Railroad Bridge) at the southern edge of Parachute. The bridge constriction causes about 22 percent of the 100-year flood discharge to overflow the tracks and flow overland in a southeasterly direction towards the Colorado River.

If this bridge could be enlarged to accommodate the 100-year discharge without causing excessive backwater effects, the flood elevation at First Street would be lowered, by 2.2 ft. to an elevation of 5,095.2 (see figure 1). Some additional reduction in flood elevation could be achieved if other bridges such as Interstate 70 and First Street were also enlarged. These bridge constrictions contribute to severe imundation of a large portion of the town upstream of these crossings

The railroad bridge on Roan Creek (Sec 139) also causes significant backwater effect. If this bridge were enlarged to accommodate the 100-year discharge, the flood elevations at Section 140, midway between the railroad and Road 44, would be lowered by 2.7 ft. to an elevation of 4,906.5. However, the hydraulic affect of an enlarged railroad bridge would essentially be gone at Road 44 (see figure 2). Any reduction in flood elevations at this location and above would have to come from changes to the Road 44 bridge.

Other structural measures such as floodwater retarding dams could also alleviate flooding. This alternative was not studied herein because of the amount of time and data required.

RECOMMENDATIONS

The following recommendations are included for considertion in reducing potential flood damages.

1. Local units of government should implement a flood plain management plan.
2. Existing restrictions that contribute to overbank flooding should be corrected where possible and when possible.
3. Detailed studies of specific structural alternative measures such as floodways and dikes to reduce flooding should be considered.
4. Owners and occupants of buildings and other property within or adjacent to the delineated flood boundary should consider flood insurance.
5. Public information and education programs on flood hazards should be made available to the public.
6. Native habitat along the main channels should be maintained to preserve channel stability and provide wildlife habitat.

GLOSSARY OF TERMS

Channel - A natural or artificial water course of perceptible extent with definite banks to confine and conduct continuously or periodically flowing water. Channel flow is that water which is flowing within the limits of the defined channel.

Flood - Water from a river, stream, water course, lake or other body of standing water, that temporarily overflows the boundaries within which it is ordinarily confined.

Flood Crest - The maximum stage or elevtion reached by the waters of a flood at a given location.

Flood Frequency - A means of expressing the probability of flood occurrences as determined from statistical analysis of representative streamflow or rainfall and runoff records. The frequency of a particular stage or discharge is usually expressed as occurring once in a specified number of years. The 10-, 25-, 50-, 100- and 500-year frequency floods have an average frequency of occurrence in the order of once in the number of years as indicated.

10-Year Flood - A flood having an average frequency of occurrence of once in 10 years. It has a 10 percent chance of being equaled or exceeded in any given year.

100-Year Flood - A flood having an average frequency of occurrence of once in 100 years. It has a 1 percent chance of being equaled or exceeded in any given year.

Flood Hazard Areas - Areas susceptible to flood damage.

Flood Peak - The highest stage or discharge attained during a flood event; also referred to as peak stage or peak discharge.

Flood Plain - The relatively flat or lowland area adjoining a river, stream, watercourse, lake, or other body of standing water which has been or may be covered temporarily by flood water. For administrative purposes the flood plain may be defined as the area that would be inundated by the 100-year flood.

Left Stream Bank - The left bank of the stream when looking downstream.

Perched Channel Flow - A condition where the flow elevation in the outer portions of the flood plain is higher than the flow elevation in the main channel. This condition occurs when a higher secondary channel receives inflow from some location upstream and maintains a flatter slope than the main channel.

Reach - A hydraulic engineering term used to describe longitudinal segments of a stream or river.

Right Stream Bank - The right bank of the stream when looking downstream.

Runoff - That part of precipitation, as well as any other flow contributions, which appears in surface streams of either perennial or intermittent form.

Stream - Any natural channel or depression through which water flows whether continuously, intermittently, or periodically, including modification of the natural channel or depression.

Structure - Anything constructed or erected, the use of which requires a more or less permanent location on or in the ground. Includes but is not limited to bridges, buildings, canals, dams, ditches, diversions, irrigation systems, pumps, pipelines, railroads, roads sewage disposal systems, underground conduits, water supply systems and wells.

Typical Valley Cross Section - An engineering drawing of a vertical section of a stream channel and adjoining landscape as viewed in a downstream direction. The drawing represents a specified location

within a designated stream reach.

Water Surface Profile - (This term is synonymous with Flood Profile) - a graph showing the relationship of the water surface elevation of a flood event to location along a stream or river.

Watersheds - A drainage basin or area which collects runoff and transmits it usually by means of streams and tributaries to the outlet of the basin.

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U.S. Water Resources Council - A Unified National Program for Flood Plain Management, September 1979.

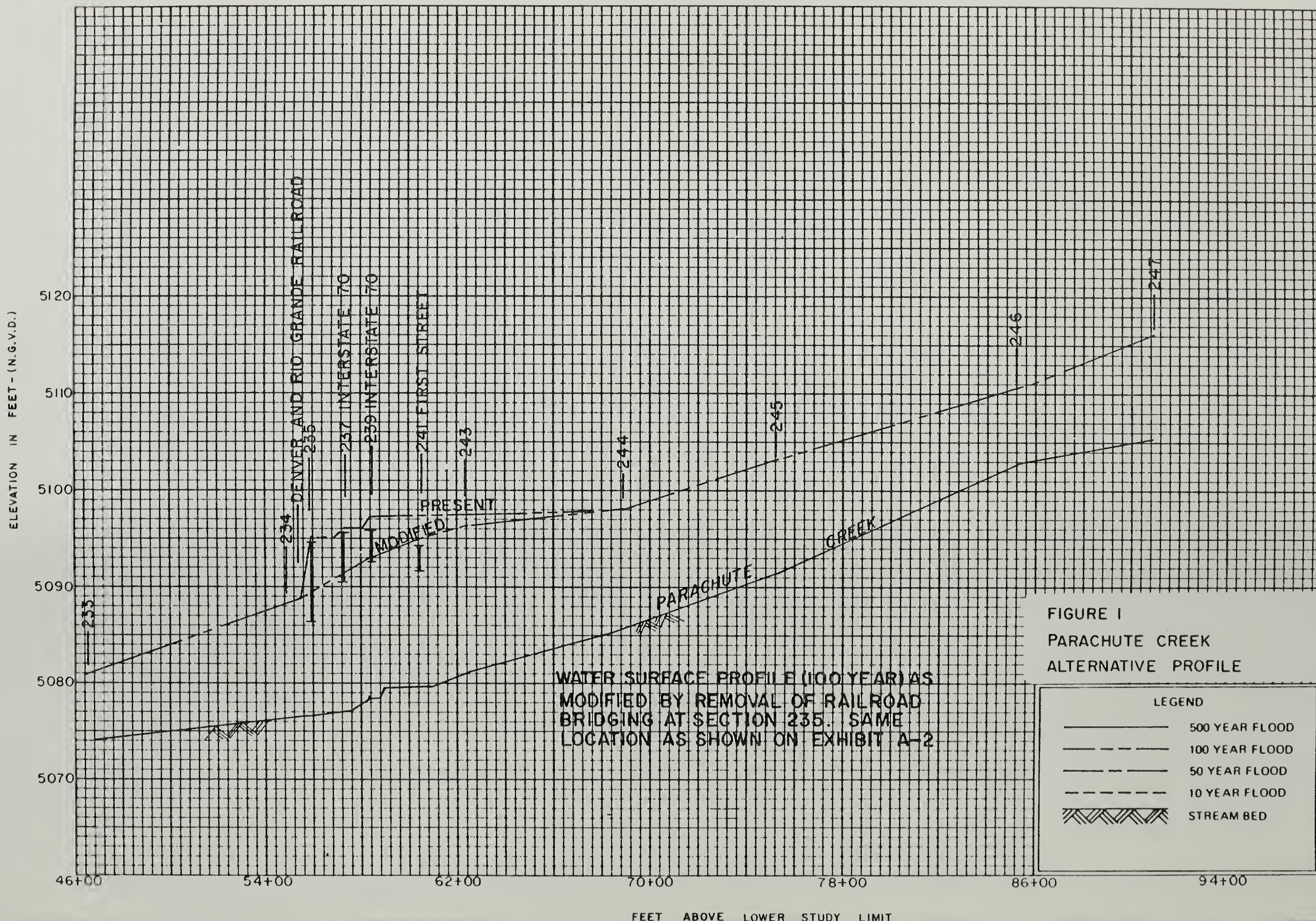


FIGURE I
PARACHUTE CREEK
ALTERNATIVE PROFILE

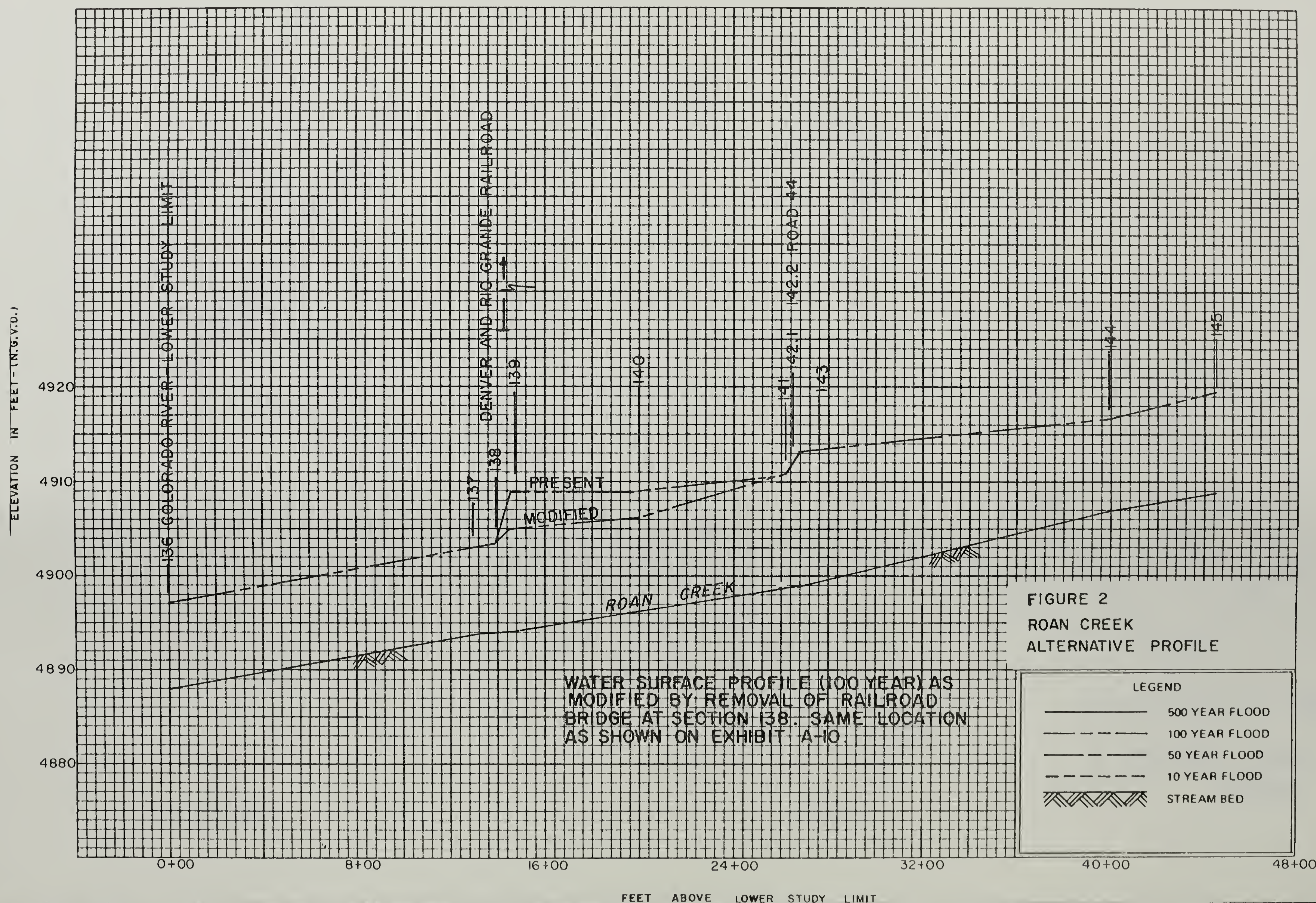
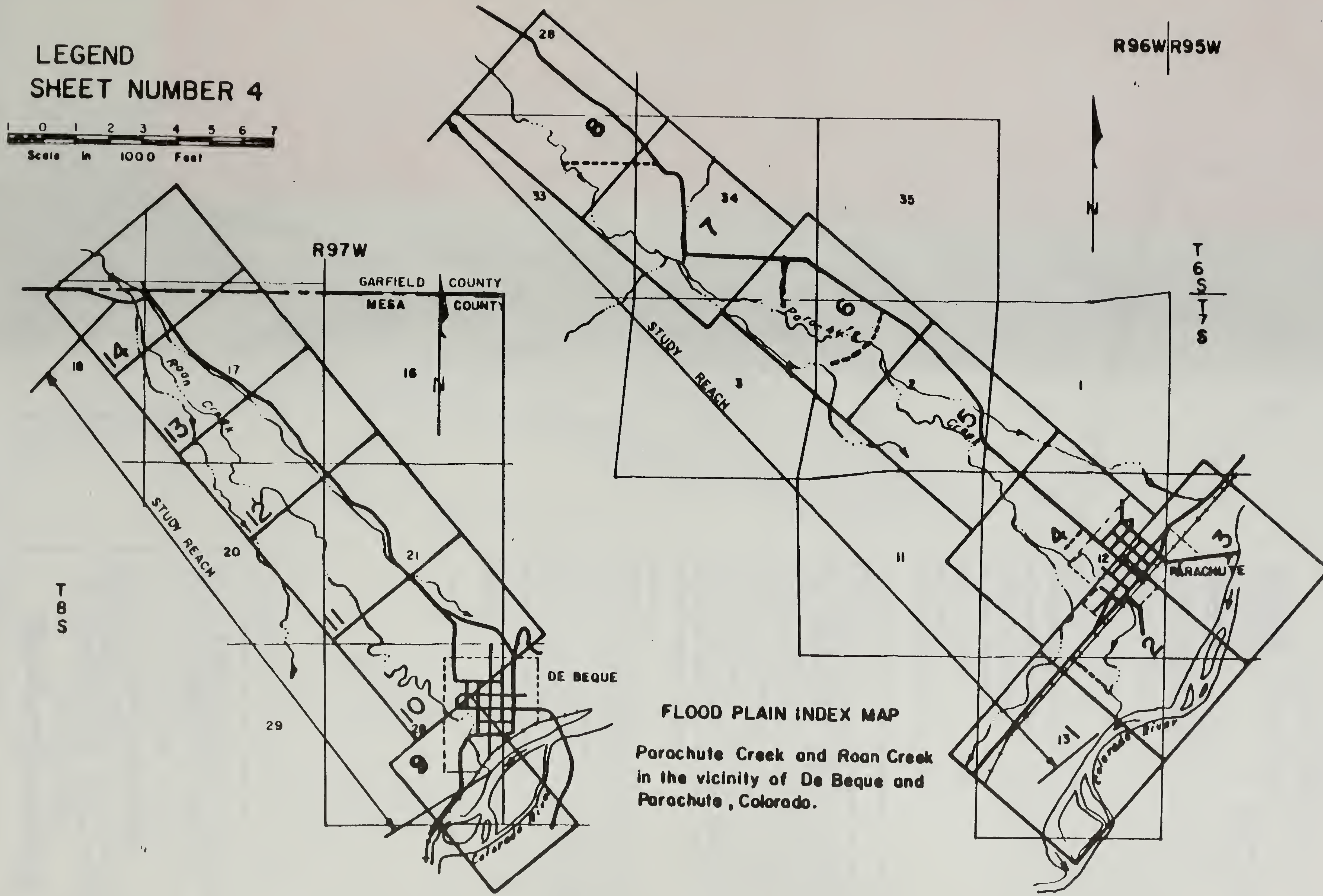
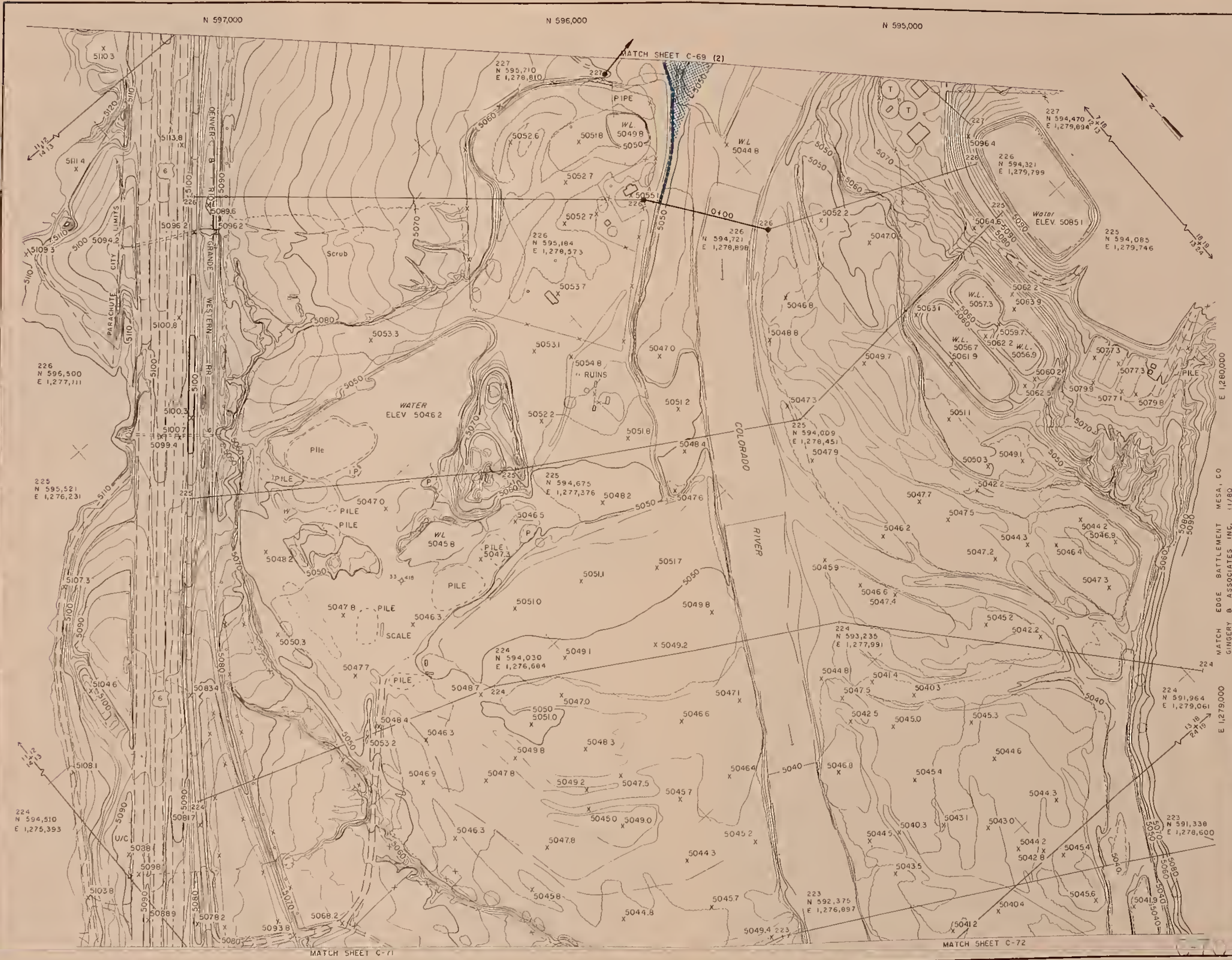


FIGURE 2
ROAN CREEK
ALTERNATIVE PROFILE



FLOOD PLAIN INDEX MAP

Parachute Creek and Roan Creek in the vicinity of De Beque and Parachute, Colorado.



LEGEND

FLOOD PLAIN LIMITS

100 YEAR FLOOD

500 YEAR FLOOD

GROUND ELEVATION IN FEET MEAN SEA LEVEL DATUM — 5280

CONTOUR INTERVAL 2.0' SHEETS 1-11

CONTOUR INTERVAL 5.0' SHEETS 12-14

CROSS SECTION A — A

CROSS SECTION CONTINUED

INTERMITTENT STREAM

HORIZONTAL CONTROL △272

VERTICAL CONTROL

PHOTO CENTER

GRID POINT

100 YEAR FLOOD ELEV. 5280

C-69 INDEX NUMBER FOR COLORADO RIVER MAPPING PROJECT

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THESE MAPS COMPLY WITH NATIONAL MAP ACCURACY STANDARDS.

SHEET INDEX

ROAN CREEK — PARACHUTE CREEK

14 13 12 11 10 9 — 8 7 6 5 4 1 2 3

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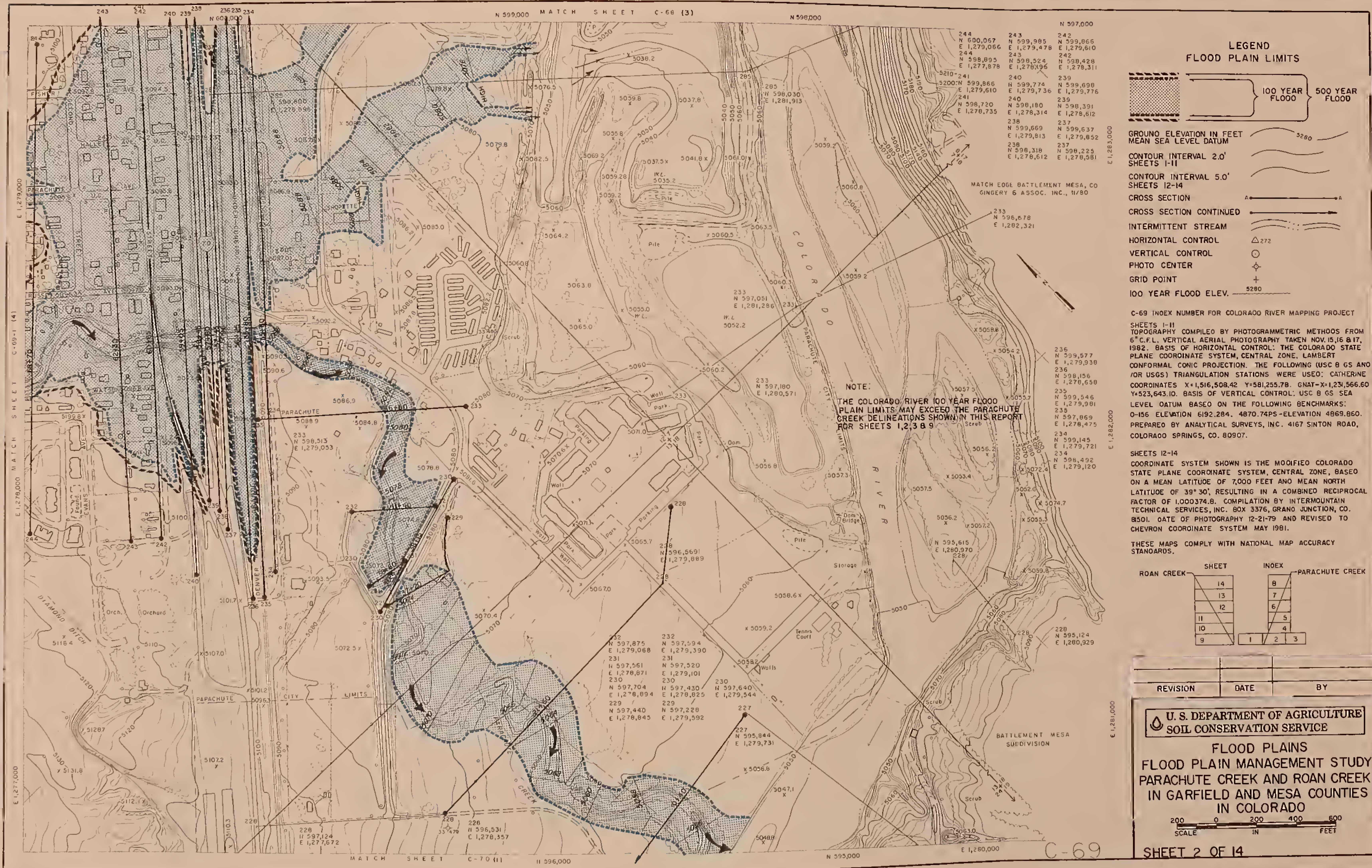
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

FLOOD PLAINS
FLOOD PLAIN MANAGEMENT STUDY
PARACHUTE CREEK AND ROAN CREEK
IN GARFIELD AND MESA COUNTIES
IN COLORADO

SCALE 200 0 200 400 600 IN FEET

SHEET 1 OF 14


MATCH SHEET C-68 (3)
LEGEND
FLOOD PLAIN LIMITS
100 YEAR FLOOD
500 YEAR FLOOD
GROUND ELEVATION IN FEET MEAN SEA LEVEL DATUM
CONTOUR INTERVAL 2.0' SHEETS 1-11
CONTOUR INTERVAL 5.0' SHEETS 12-14
CROSS SECTION
CROSS SECTION CONTINUED
INTERMITTENT STREAM
HORIZONTAL CONTROL
VERTICAL CONTROL
PHOTO CENTER
GRID POINT
100 YEAR FLOOD ELEV.
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ROAN CREEK
SHEET
INDEX
PARACHUTE CREEK
NOTE:
THE COLORADO RIVER 100 YEAR FLOOD PLAIN LIMITS MAY EXCEED THE PARACHUTE CREEK DELINEATIONS SHOWN IN THIS REPORT FOR SHEETS 1,2,3 & 9.
MATCH EDGE BATTLEMENT MESA, CO GINGERY & ASSOC. INC., 11/80
COLORADO RIVER
PARACHUTE CITY LIMITS
BATTLEMENT MESA SUBDIVISION
DIAMOND DITCH
DENVER
Tennis Court
Storage
MATCH SHEET C-69-1 (4)
MATCH SHEET C-70 (1)
REVISION
DATE
BY
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
FLOOD PLAINS
FLOOD PLAIN MANAGEMENT STUDY
PARACHUTE CREEK AND ROAN CREEK
IN GARFIELD AND MESA COUNTIES
IN COLORADO
SCALE IN FEET
C-69
SHEET 2 OF 14

LEGEND

FLOOD PLAIN LIMITS

100 YEAR FLOOD

500 YEAR FLOOD

GROUND ELEVATION IN FEET MEAN SEA LEVEL DATUM 5280

CONTOUR INTERVAL 2.0' SHEETS 1-11

CONTOUR INTERVAL 5.0' SHEETS 12-14

CROSS SECTION

CROSS SECTION CONTINUED

INTERMITTENT STREAM

HORIZONTAL CONTROL △272

VERTICAL CONTROL

PHOTO CENTER

GRID POINT

100 YEAR FLOOD ELEV. 5280

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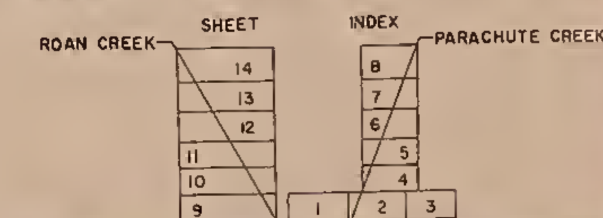

REVISION	DATE	BY

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

FLOOD PLAINS
FLOOD PLAIN MANAGEMENT STUDY
PARACHUTE CREEK AND ROAN CREEK
IN GARFIELD AND MESA COUNTIES
IN COLORADO

SCALE IN FEET 200 0 200 400 600

SHEET 3 OF 14


MATCH SHEET C-69-2 (5)
LEGEND
FLOOD PLAIN LIMITS
100 YEAR FLOOD
500 YEAR FLOOD
GROUND ELEVATION IN FEET MEAN SEA LEVEL DATUM
CONTOUR INTERVAL 2.0' SHEETS 1-11
CONTOUR INTERVAL 5.0' SHEETS 12-14
CROSS SECTION
CROSS SECTION CONTINUED
INTERMITTENT STREAM
HORIZONTAL CONTROL
VERTICAL CONTROL
PHOTO CENTER
GRID POINT
100 YEAR FLOOD ELEV.
C-69 INDEX NUMBER FOR COLORADO RIVER MAPPING PROJECT
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ROAN CREEK
PARACHUTE CREEK
SHEET
INDEX
MATCH EDGE PARACHUTE, CO. NORTHWAY-GESTALT, 4/82
PARACHUTE CITY LIMITS
PARACHUTE
FOURTH STREET
THIRD STREET
Athletic Field
CEMETERY
REVISION
DATE
BY
U. S. DEPARTMENT OF AGRICULTURE
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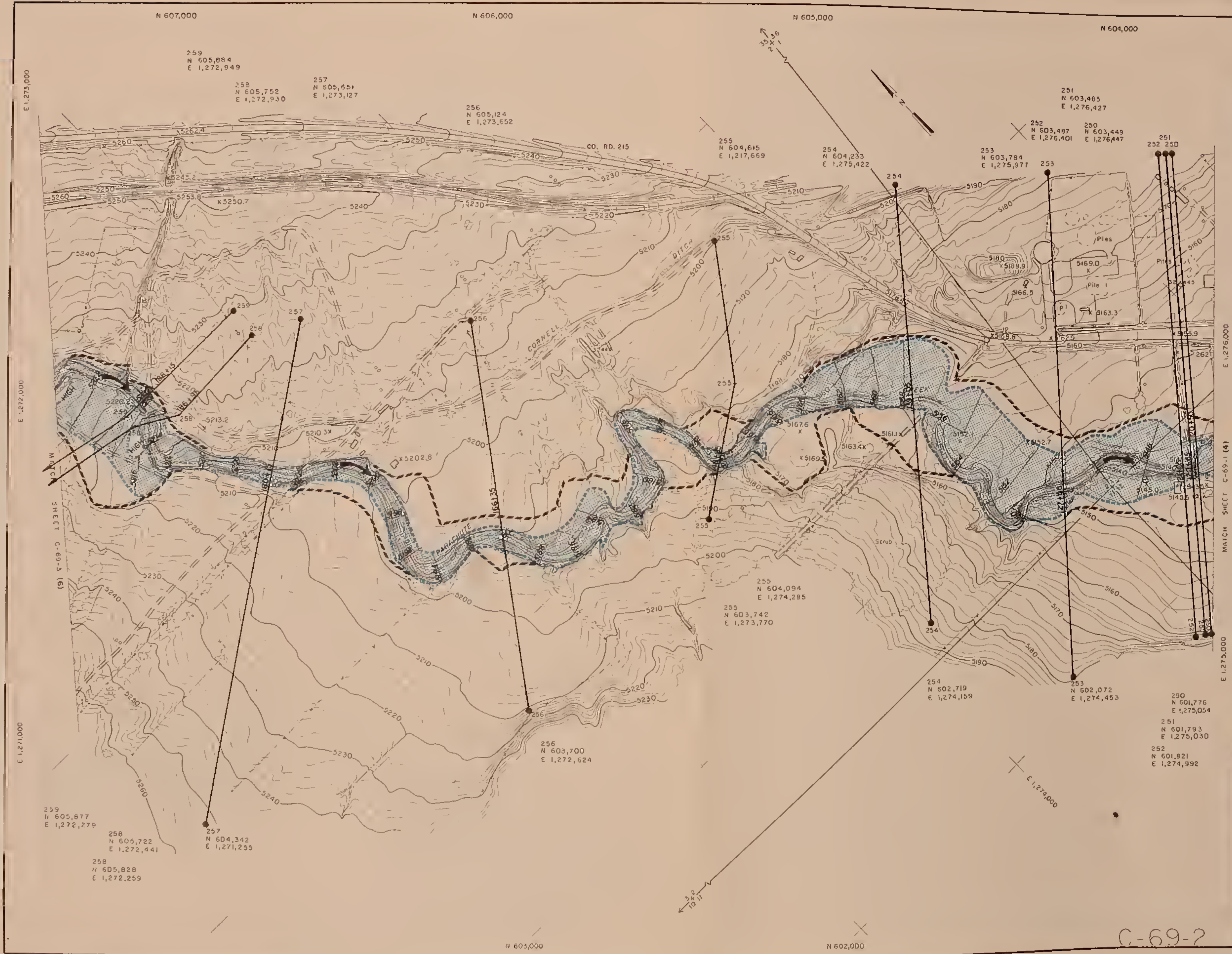
IN COLORADO
SCALE IN FEET
MATCH SHEET C-69 (2)
MATCH SHEET C-68 (3)
C-69-1
SHEET 4 OF 14



LEGEND

FLOOD PLAIN LIMITS

100 YEAR FLOOD
500 YEAR FLOOD

GROUND ELEVATION IN FEET MEAN SEA LEVEL DATUM

CONTOUR INTERVAL 2.0' SHEETS 1-11

CONTOUR INTERVAL 5.0' SHEETS 12-14

CROSS SECTION

CROSS SECTION CONTINUED

INTERMITTENT STREAM

HORIZONTAL CONTROL

VERTICAL CONTROL

PHOTO CENTER

GRID POINT

100 YEAR FLOOD ELEV. 5280

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ROAN CREEK: 14, 13, 12, 11, 10, 9

PARACHUTE CREEK: 8, 7, 6, 5, 4, 1, 2, 3

REVISION	DATE	BY

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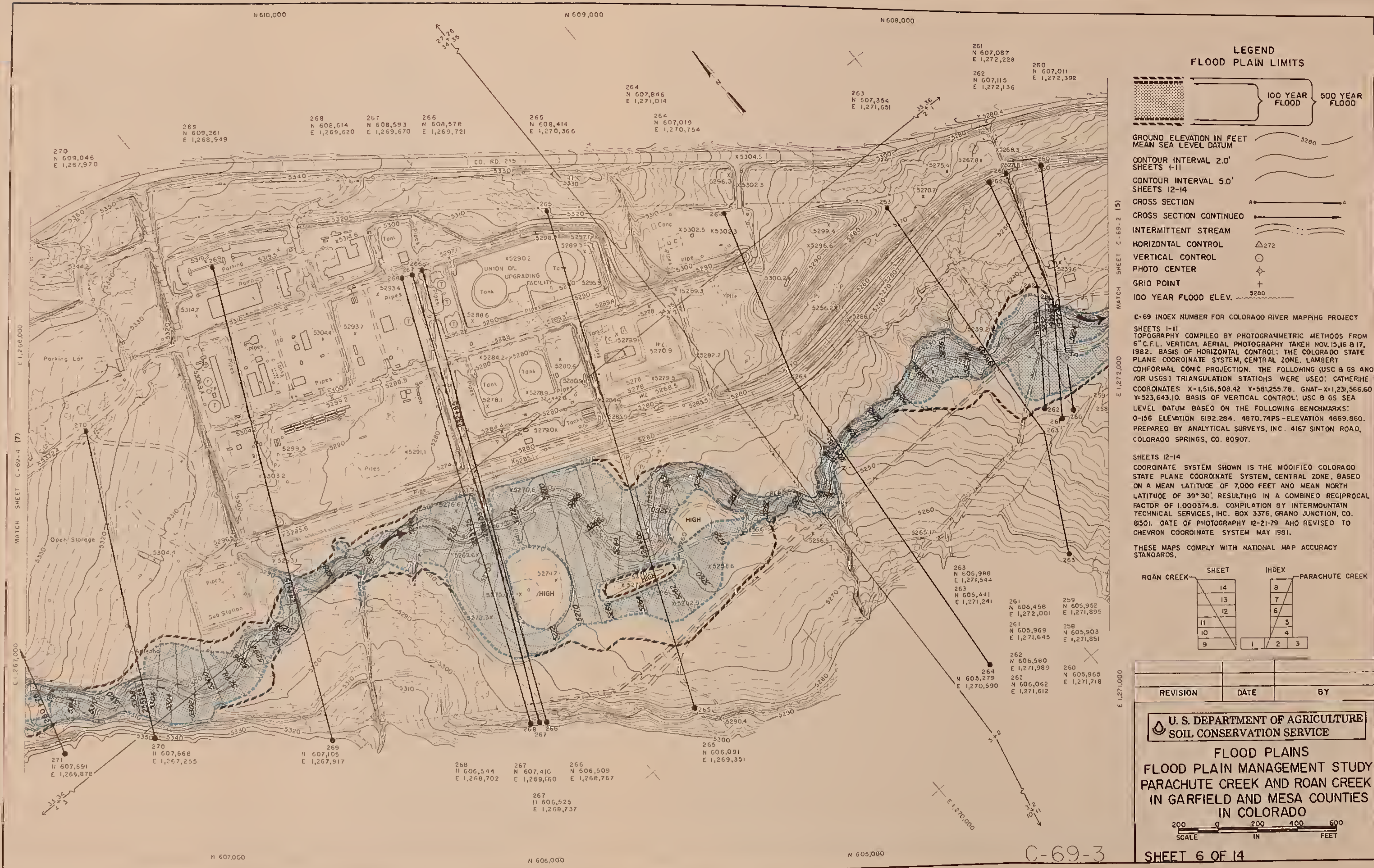
FLOOD PLAINS
FLOOD PLAIN MANAGEMENT STUDY
PARACHUTE CREEK AND ROAN CREEK
IN GARFIELD AND MESA COUNTIES
IN COLORADO

SCALE IN FEET: 200 0 200 400 600

SHEET 5 OF 14


LEGEND
FLOOD PLAIN LIMITS
100 YEAR FLOOD
500 YEAR FLOOD
GROUND ELEVATION IN FEET MEAN SEA LEVEL DATUM
CONTOUR INTERVAL 2.0' SHEETS 1-11
CONTOUR INTERVAL 5.0' SHEETS 12-14
CROSS SECTION
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IN GARFIELD AND MESA COUNTIES
IN COLORADO
SCALE IN FEET
SHEET 6 OF 14
C-69-3
MATCH SHEET C-69-4 (7)
MATCH SHEET C-69-2 (5)
CO. RD. 215
UNION OIL UPGRADING FACILITY
Parking Lot
Open Storage
Sub Station
HIGH
N 610,000
N 609,000
N 608,000
N 607,000
N 606,000
N 605,000
E 1,268,000
E 1,267,000
E 1,272,000
E 1,271,000
E 1,270,000

LEGEND
FLOOD PLAIN LIMITS
100 YEAR FLOOD
500 YEAR FLOOD
GROUND ELEVATION IN FEET MEAN SEA LEVEL DATUM
CONTOUR INTERVAL 2.0' SHEETS 1-11
CONTOUR INTERVAL 5.0' SHEETS 12-14
CROSS SECTION
CROSS SECTION CONTINUED
INTERMITTENT STREAM
HORIZONTAL CONTROL
VERTICAL CONTROL
PHOTO CENTER
GRID POINT
100 YEAR FLOOD ELEV.
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C-69-4
MATCH SHEET C-69-5 (8)
MATCH SHEET C-69-3 (6)
CO. RD. 215
PARACHUTE CREEK
Open Storage
Ruins
Orchard
Parking Lot
Water Elev. 5378.2

LEGEND

FLOOD PLAIN LIMITS

100 YEAR FLOOD

500 YEAR FLOOD

GROUND ELEVATION IN FEET MEAN SEA LEVEL DATUM — 5280

CONTOUR INTERVAL 2.0' SHEETS 1-11

CONTOUR INTERVAL 5.0' SHEETS 12-14

CROSS SECTION

CROSS SECTION CONTINUED

INTERMITTENT STREAM

HORIZONTAL CONTROL △272

VERTICAL CONTROL

PHOTO CENTER

GRID POINT

100 YEAR FLOOD ELEV. 5280

C-69 INDEX NUMBER FOR COLORADO RIVER MAPPING PROJECT

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PARACHUTE CREEK: 8, 7, 6, 5, 4, 1, 2, 3

REVISION	DATE	BY

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

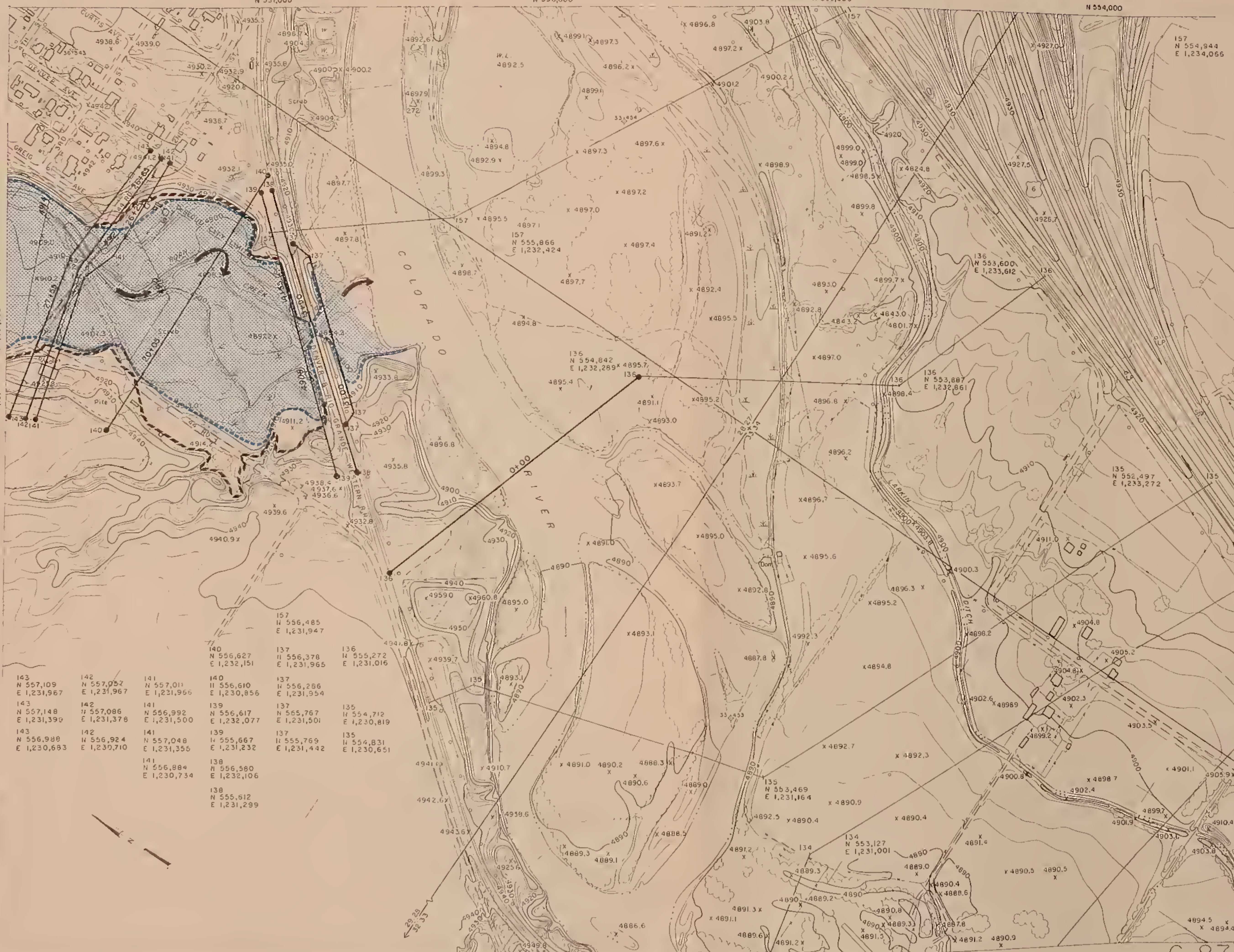
FLOOD PLAINS

FLOOD PLAIN MANAGEMENT STUDY PARACHUTE CREEK AND ROAN CREEK IN GARFIELD AND MESA COUNTIES IN COLORADO

SCALE IN FEET: 200 0 200 400 600

C-69-

SHEET 8 OF 14



LEGEND

FLOOD PLAIN LIMITS

100 YEAR FLOOD

500 YEAR FLOOD

GROUND ELEVATION IN FEET MEAN SEA LEVEL DATUM — 5280

CONTOUR INTERVAL 2.0' SHEETS 1-11

CONTOUR INTERVAL 5.0' SHEETS 12-14

CROSS SECTION — A A

CROSS SECTION CONTINUED

INTERMITTENT STREAM

HORIZONTAL CONTROL — △272

VERTICAL CONTROL

PHOTO CENTER

GRID POINT

100 YEAR FLOOD ELEV. — 5280

C-69 INDEX NUMBER FOR COLORADO RIVER MAPPING PROJECT

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SHEETS 12-14

COORDINATE SYSTEM SHOWN IS THE MODIFIED COLORADO STATE PLANE COORDINATE SYSTEM, CENTRAL ZONE, BASED ON A MEAN LATITUDE OF 7,000 FEET AND MEAN NORTH LATITUDE OF 39° 30', RESULTING IN A COMBINED RECIPROCAL FACTOR OF 1.000374.8. COMPILATION BY INTERMOUNTAIN TECHNICAL SERVICES, INC. BOX 3376, GRAND JUNCTION, CO. 81501. DATE OF PHOTOGRAPHY 12-21-79 AND REVISED TO CHEVRON COORDINATE SYSTEM MAY 1981.

THESE MAPS COMPLY WITH NATIONAL MAP ACCURACY STANDARDS.

SHEET INDEX

ROAN CREEK: 14, 13, 12, 11, 10, 9

PARACHUTE CREEK: 8, 7, 6, 5, 4, 1, 2, 3

REVISION	DATE	BY

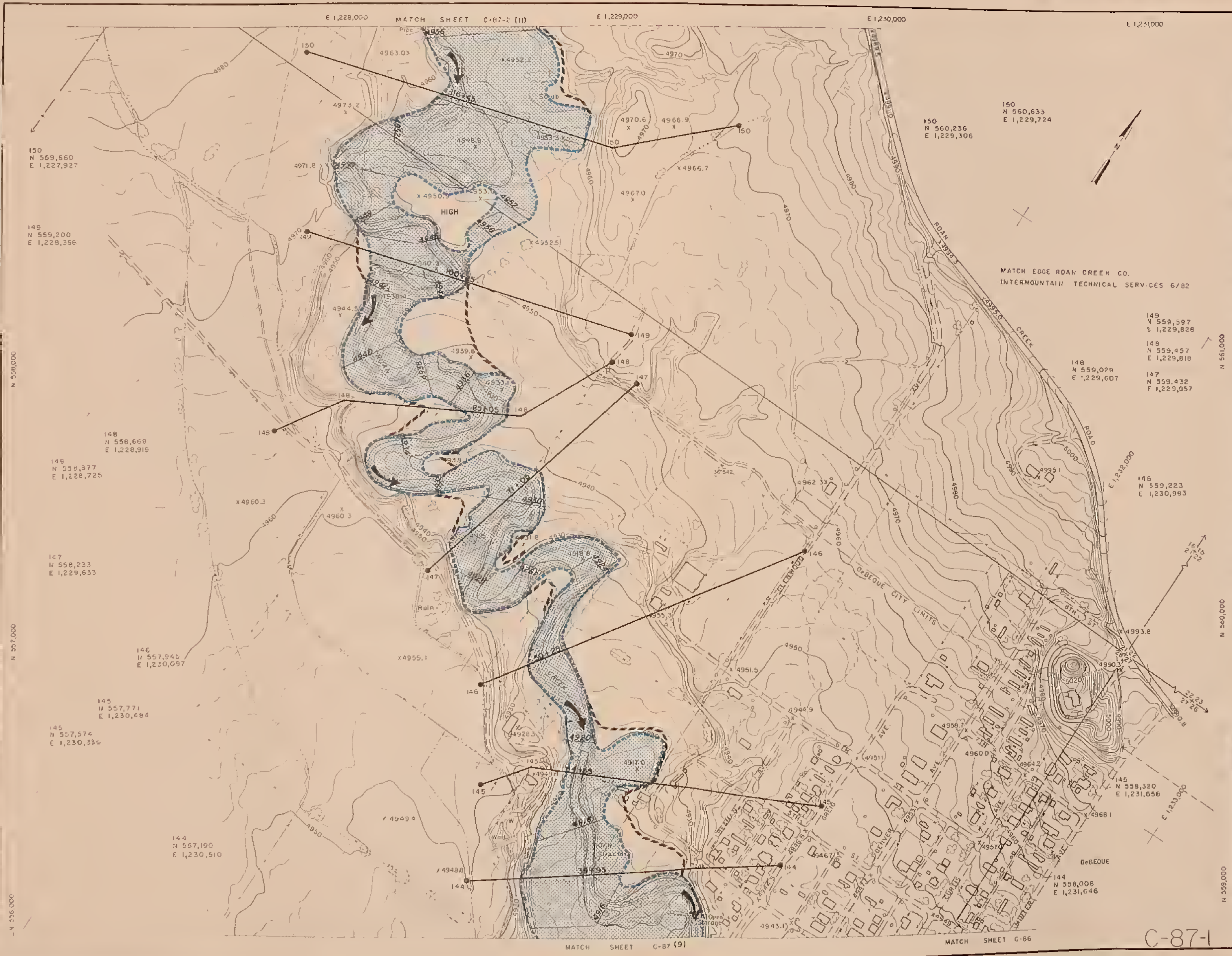
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

FLOOD PLAINS

FLOOD PLAIN MANAGEMENT STUDY PARACHUTE CREEK AND ROAN CREEK IN GARFIELD AND MESA COUNTIES IN COLORADO

SCALE 200 0 200 400 600 IN FEET

SHEET 9 OF 14



LEGEND

FLOOD PLAIN LIMITS

100 YEAR FLOOD

500 YEAR FLOOD

GROUND ELEVATION IN FEET MEAN SEA LEVEL DATUM 5280

CONTOUR INTERVAL 2.0' SHEETS 1-11

CONTOUR INTERVAL 5.0' SHEETS 12-14

CROSS SECTION

CROSS SECTION CONTINUED

INTERMITTENT STREAM

HORIZONTAL CONTROL △272

VERTICAL CONTROL

PHOTO CENTER

GRID POINT

100 YEAR FLOOD ELEV. 5280

C-69 INDEX NUMBER FOR COLORADO RIVER MAPPING PROJECT

SHEETS 1-11

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SHEETS 12-14

COORDINATE SYSTEM SHOWN IS THE MODIFIED COLORADO STATE PLANE COORDINATE SYSTEM, CENTRAL ZONE, BASED ON A MEAN LATITUDE OF 7,000 FEET AND MEAN NORTH LATITUDE OF 39° 30', RESULTING IN A COMBINED RECIPROCAL FACTOR OF 1.000374.8. COMPILATION BY INTERMOUNTAIN TECHNICAL SERVICES, INC. BOX 3376, GRAND JUNCTION, CO. 81501. DATE OF PHOTOGRAPHY 12-21-79 AND REVISED TO CHEVRON COORDINATE SYSTEM MAY 1981.

THESE MAPS COMPLY WITH NATIONAL MAP ACCURACY STANDARDS.

SHEET INDEX

ROAN CREEK — 14, 13, 12, 11, 10, 9

PARACHUTE CREEK — 8, 7, 6, 5, 4, 1, 2, 3

REVISION	DATE	BY

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

FLOOD PLAINS
FLOOD PLAIN MANAGEMENT STUDY
PARACHUTE CREEK AND ROAN CREEK
IN GARFIELD AND MESA COUNTIES
IN COLORADO

SCALE IN FEET 200 0 200 400 600

C-87-1

SHEET 10 OF 14


LEGEND
FLOOD PLAIN LIMITS
100 YEAR FLOOD
500 YEAR FLOOD
GROUND ELEVATION IN FEET MEAN SEA LEVEL DATUM
CONTOUR INTERVAL 2.0' SHEETS 1-11
CONTOUR INTERVAL 5.0' SHEETS 12-14
CROSS SECTION
CROSS SECTION CONTINUED
INTERMITTENT STREAM
HORIZONTAL CONTROL
VERTICAL CONTROL
PHOTO CENTER
GRID POINT
100 YEAR FLOOD ELEV.
C-69 INDEX NUMBER FOR COLORADO RIVER MAPPING PROJECT
SHEETS 1-11
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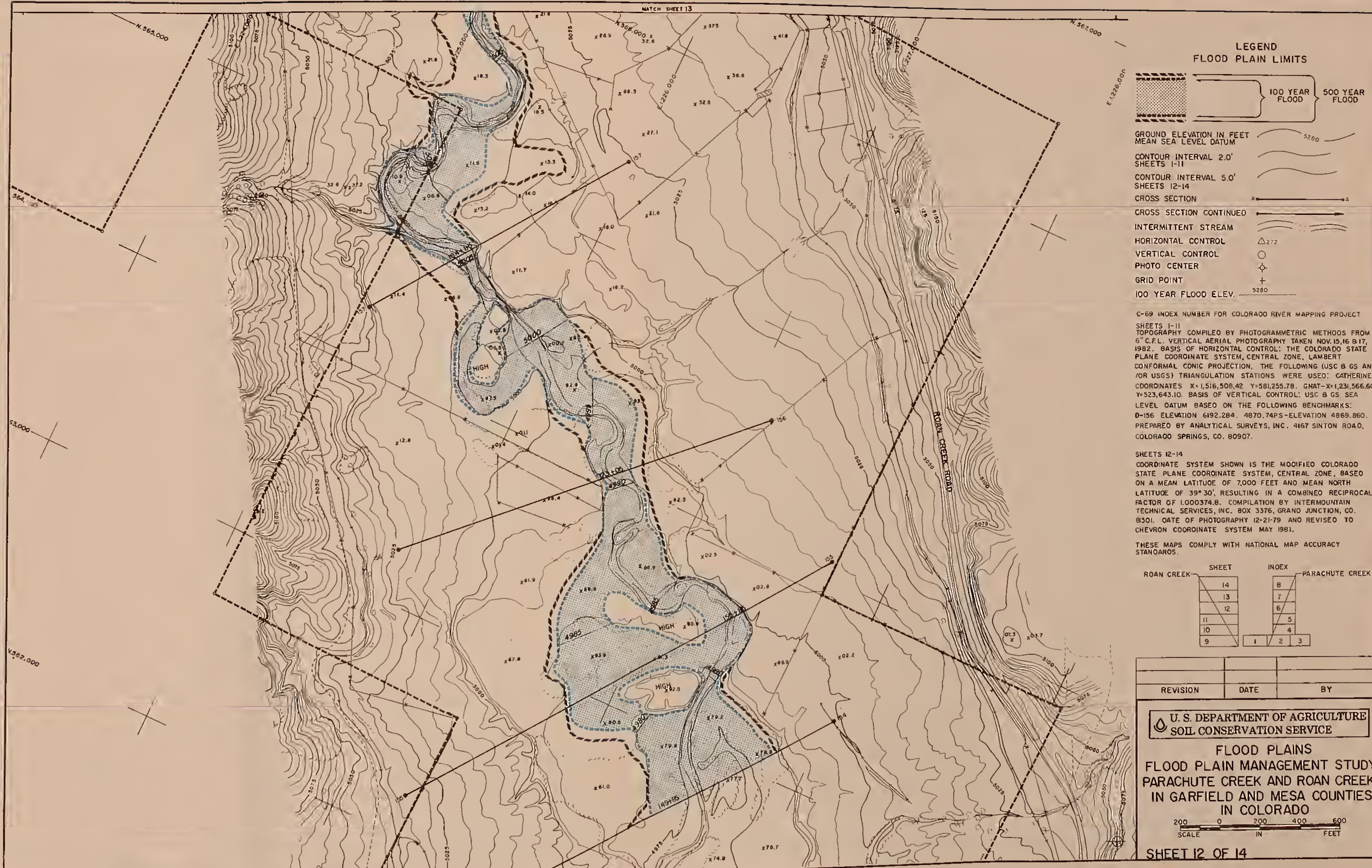
THESE MAPS COMPLY WITH NATIONAL MAP ACCURACY STANDARDS.
ROAN CREEK
SHEET
INDEX
PARACHUTE CREEK
REVISION
DATE
BY
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
FLOOD PLAINS
FLOOD PLAIN MANAGEMENT STUDY
PARACHUTE CREEK AND ROAN CREEK
IN GARFIELD AND MESA COUNTIES
IN COLORADO
SCALE IN FEET
SHEET 11 OF 14
C-87-2
MATCH SHEET 12
MATCH SHEET C-87-1 (10)
MATCH EDGE ROAN CREEK CO. INTERMOUNTAIN TECHNICAL SEVICES 6/82
ROAN CREEK DITCH NO. 2
ROAN CREEK
Athletic Field
Tennis Court
Scrub
E 1,225,000
E 1,226,000
E 1,227,000
E 1,228,000
E 1,229,000
E 1,230,000
N 561,000
N 560,000
N 564,000
N 563,000
N 562,000
154 N 563,223 E 1,227,569
155 N 562,012 E 1,225,821
154 N 561,858 E 1,226,490
153 N 562,817 E 1,228,109
153 N 561,358 E 1,227,049
152 N 561,814 E 1,228,606
152 N 560,922 E 1,227,650
151 N 561,160 E 1,229,041
151 N 560,747 E 1,228,799
151 N 560,499 E 1,228,062
N 563,922 E 1,227,235



MATCH SHEET 13
LEGEND
FLOOD PLAIN LIMITS
100 YEAR FLOOD
500 YEAR FLOOD
GROUND ELEVATION IN FEET MEAN SEA LEVEL DATUM
CONTOUR INTERVAL 2.0' SHEETS 1-11
CONTOUR INTERVAL 5.0' SHEETS 12-14
CROSS SECTION
CROSS SECTION CONTINUED
INTERMITTENT STREAM
HORIZONTAL CONTROL
VERTICAL CONTROL
PHOTO CENTER
GRID POINT
100 YEAR FLOOD ELEV.
C-69 INDEX NUMBER FOR COLORADO RIVER MAPPING PROJECT
SHEETS 1-11
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THESE MAPS COMPLY WITH NATIONAL MAP ACCURACY STANDARDS.
SHEET INDEX
ROAN CREEK
PARACHUTE CREEK
ROAN CREEK ROAD
HIGH
REVISION
DATE
BY
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
FLOOD PLAINS
FLOOD PLAIN MANAGEMENT STUDY
PARACHUTE CREEK AND ROAN CREEK
IN GARFIELD AND MESA COUNTIES
IN COLORADO
SCALE IN FEET
SHEET 12 OF 14
MATCH SHEET 11

LEGEND

FLOOD PLAIN LIMITS

100 YEAR FLOOD
500 YEAR FLOOD

GROUND ELEVATION IN FEET MEAN SEA LEVEL DATUM 5280

CONTOUR INTERVAL 2.0' SHEETS 1-11

CONTOUR INTERVAL 5.0' SHEETS 12-14

CROSS SECTION A A

CROSS SECTION CONTINUED

INTERMITTENT STREAM

HORIZONTAL CONTROL △272

VERTICAL CONTROL ○

PHOTO CENTER

GRID POINT +

100 YEAR FLOOD ELEV. 5280

C-69 INDEX NUMBER FOR COLORADO RIVER MAPPING PROJECT

SHEETS 1-11
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SHEET INDEX

ROAN CREEK: 14, 13, 12, 11, 10, 9

PARACHUTE CREEK: 8, 7, 6, 5, 4, 1, 2, 3

REVISION	DATE	BY

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

FLOOD PLAINS

FLOOD PLAIN MANAGEMENT STUDY PARACHUTE CREEK AND ROAN CREEK IN GARFIELD AND MESA COUNTIES IN COLORADO

SCALE IN FEET: 200 0 200 400 600

LEGEND

FLOOD PLAIN LIMITS

100 YEAR FLOOD — 500 YEAR FLOOD

GROUND ELEVATION IN FEET MEAN SEA LEVEL DATUM — 5280

CONTOUR INTERVAL 2.0' SHEETS 1-11

CONTOUR INTERVAL 5.0' SHEETS 12-14

CROSS SECTION

CROSS SECTION CONTINUED

INTERMITTENT STREAM

HORIZONTAL CONTROL △272

VERTICAL CONTROL

PHOTO CENTER

GRID POINT

100 YEAR FLOOD ELEV. 5260

C-69 INDEX NUMBER FOR COLORADO RIVER MAPPING PROJECT

SHEETS 1-11
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PARACHUTE CREEK: 8, 7, 6, 5, 4, 1, 2, 3

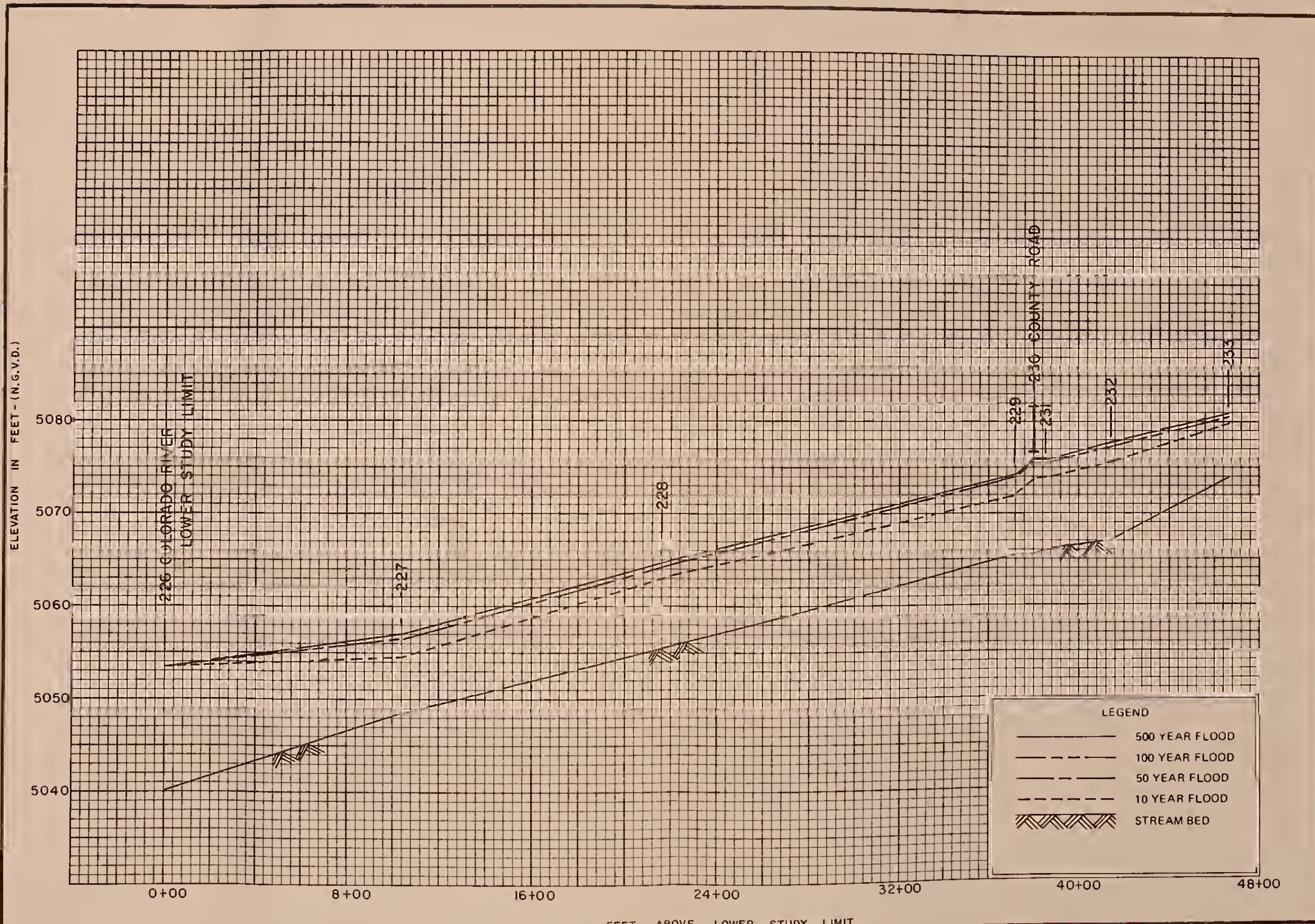
REVISION	DATE	BY

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

FLOOD PLAINS
FLOOD PLAIN MANAGEMENT STUDY
PARACHUTE CREEK AND ROAN CREEK
IN GARFIELD AND MESA COUNTIES
IN COLORADO

SCALE IN FEET: 200 0 200 400 600

SHEET 14 OF 14

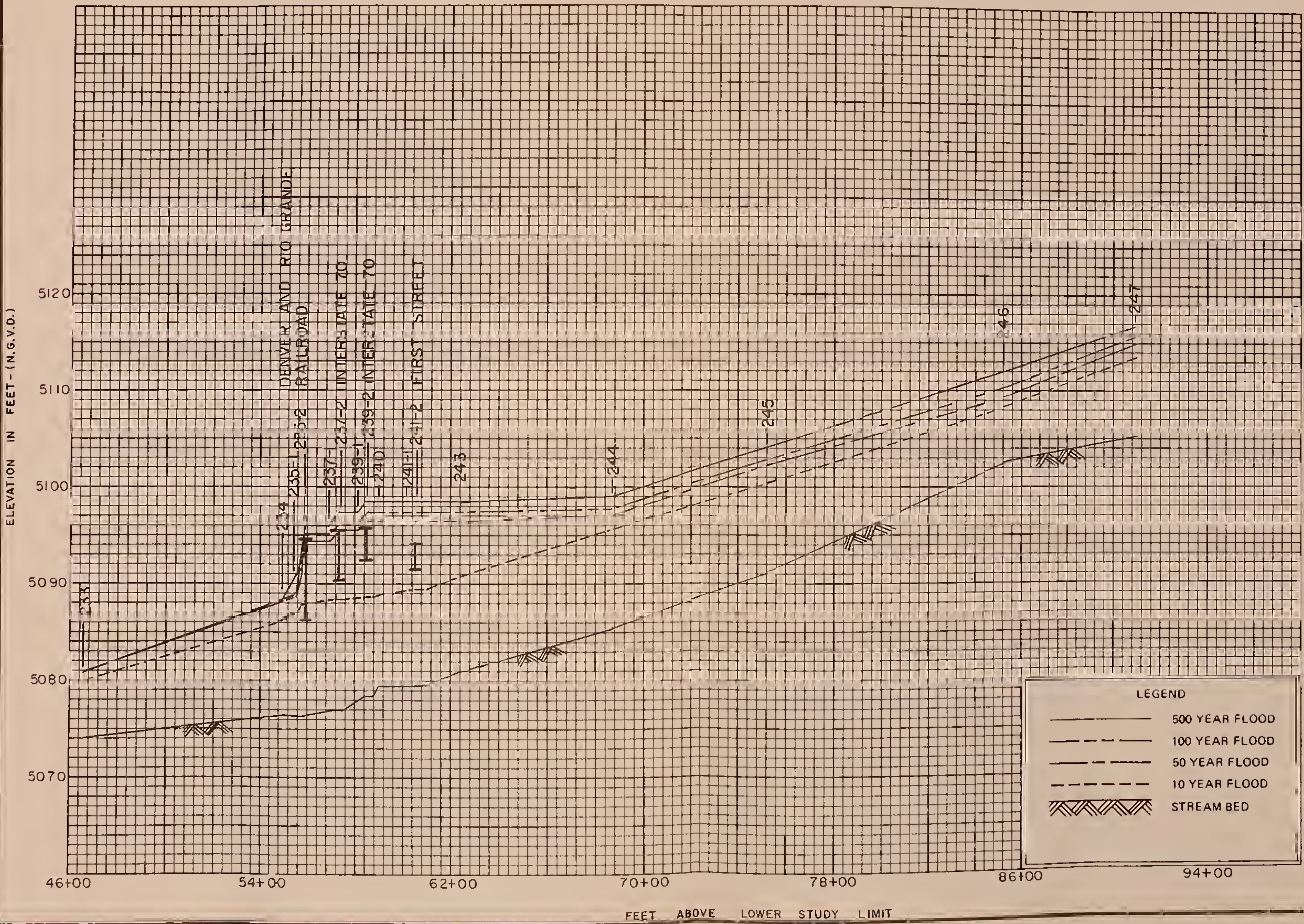


FLOOD PROFILES

PARACHUTE CREEK AND ROAN CREEK STUDY

PARACHUTE CREEK
STA. 0+00 TO 46+60
USDA-SCS

A-1

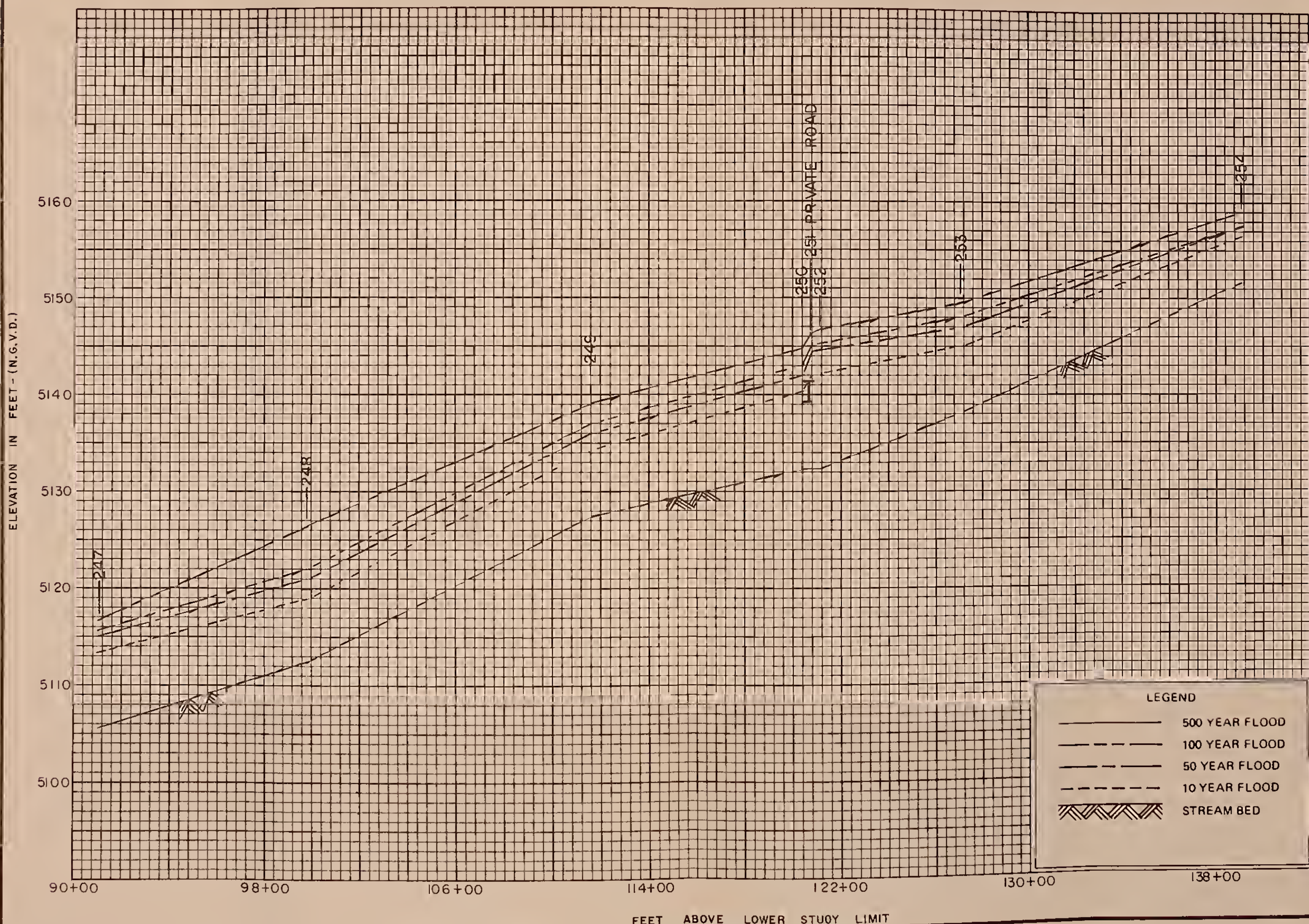


FLOOD PROFILES

PARACHUTE CREEK AND ROAN CREEK STUDY

PARACHUTE CREEK
STA. 46+60 TO 91+05
USDA-SCS

A-2

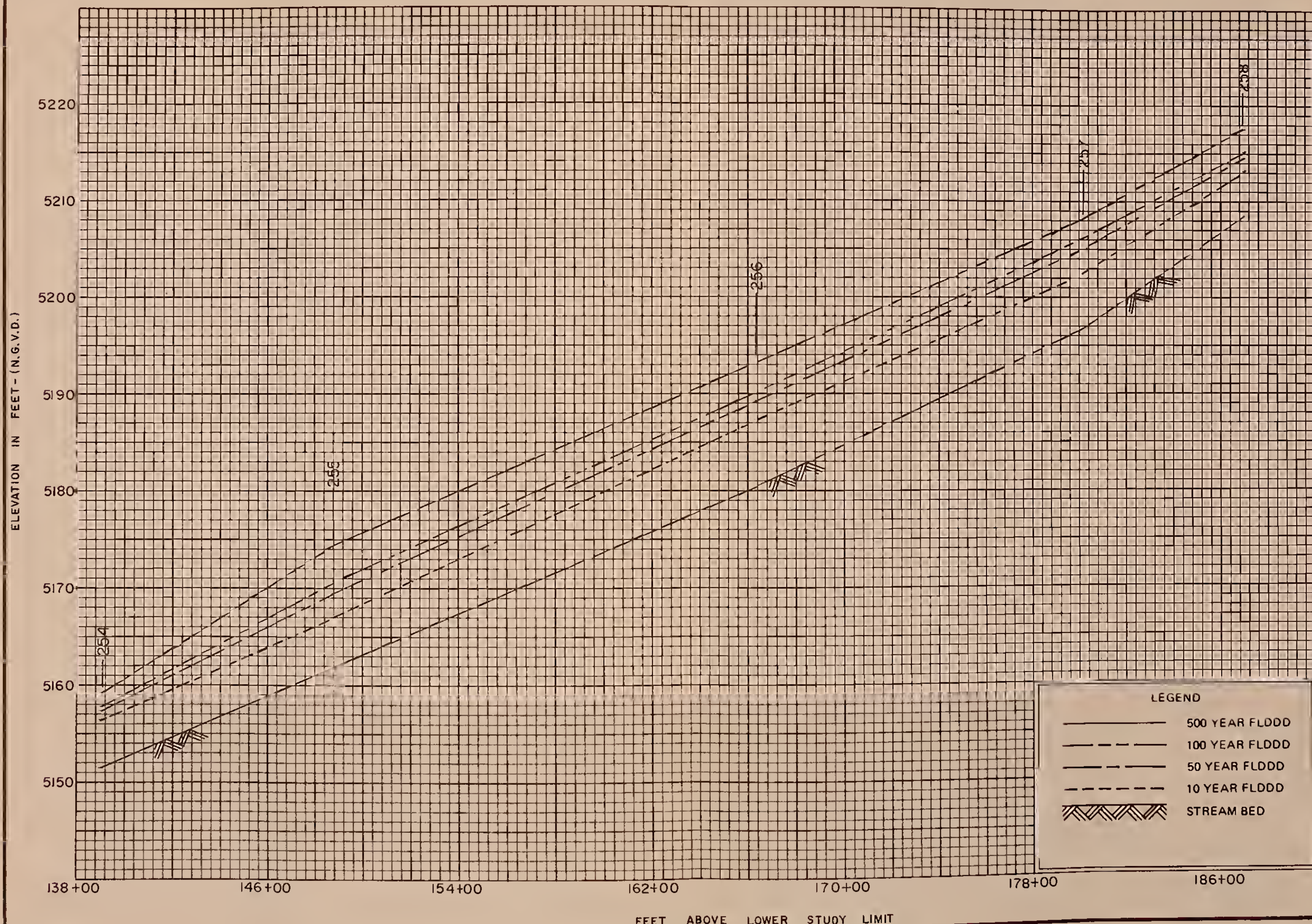


FLOOD PROFILES

PARACHUTE CREEK AND ROAN CREEK STUDY

PARACHUTE CREEK
STA. 91+05 TO 139+05
USDA-SCS

A-3



FLOOD PROFILES

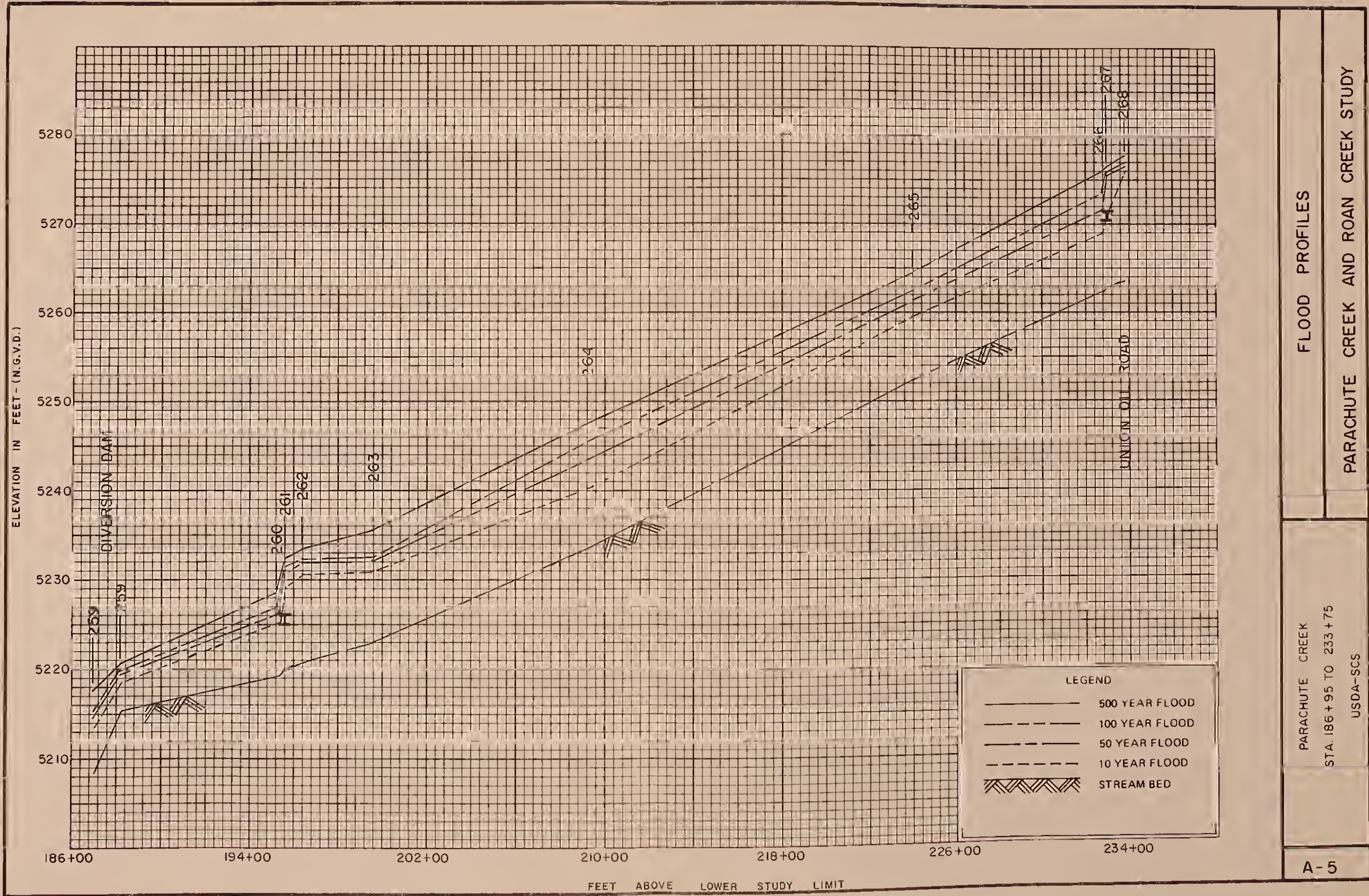
PARACHUTE CREEK AND ROAN CREEK STUDY

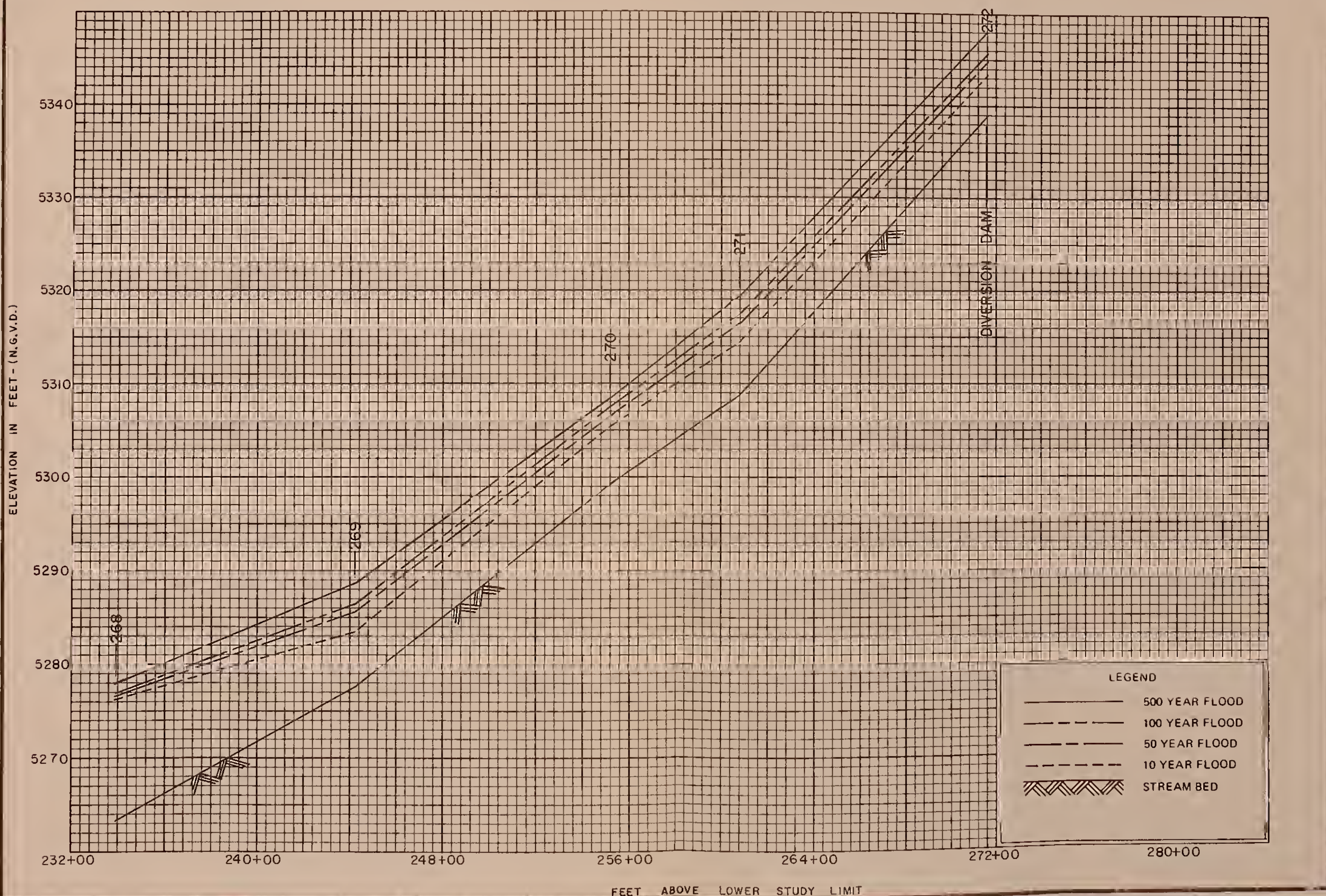
PARACHUTE CREEK

STA. 139+05 TO 186+95

USDA-SCS

A-4


FLOOD PROFILES
PARACHUTE CREEK AND ROAN CREEK STUDY
PARACHUTE CREEK
STA. 186+95 TO 233+75
USDA-SCS
A-5
ELEVATION IN FEET - (N.G.V.D.)
5280
5270
5260
5250
5240
5230
5220
5210
186+00
194+00
202+00
210+00
218+00
226+00
234+00
FEET ABOVE LOWER STUDY LIMIT
DIVERSION DAM
UNION OIL ROAD
259
260
261
262
263
264
265
266
267
268
LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
STREAM BED



FLOOD PROFILES

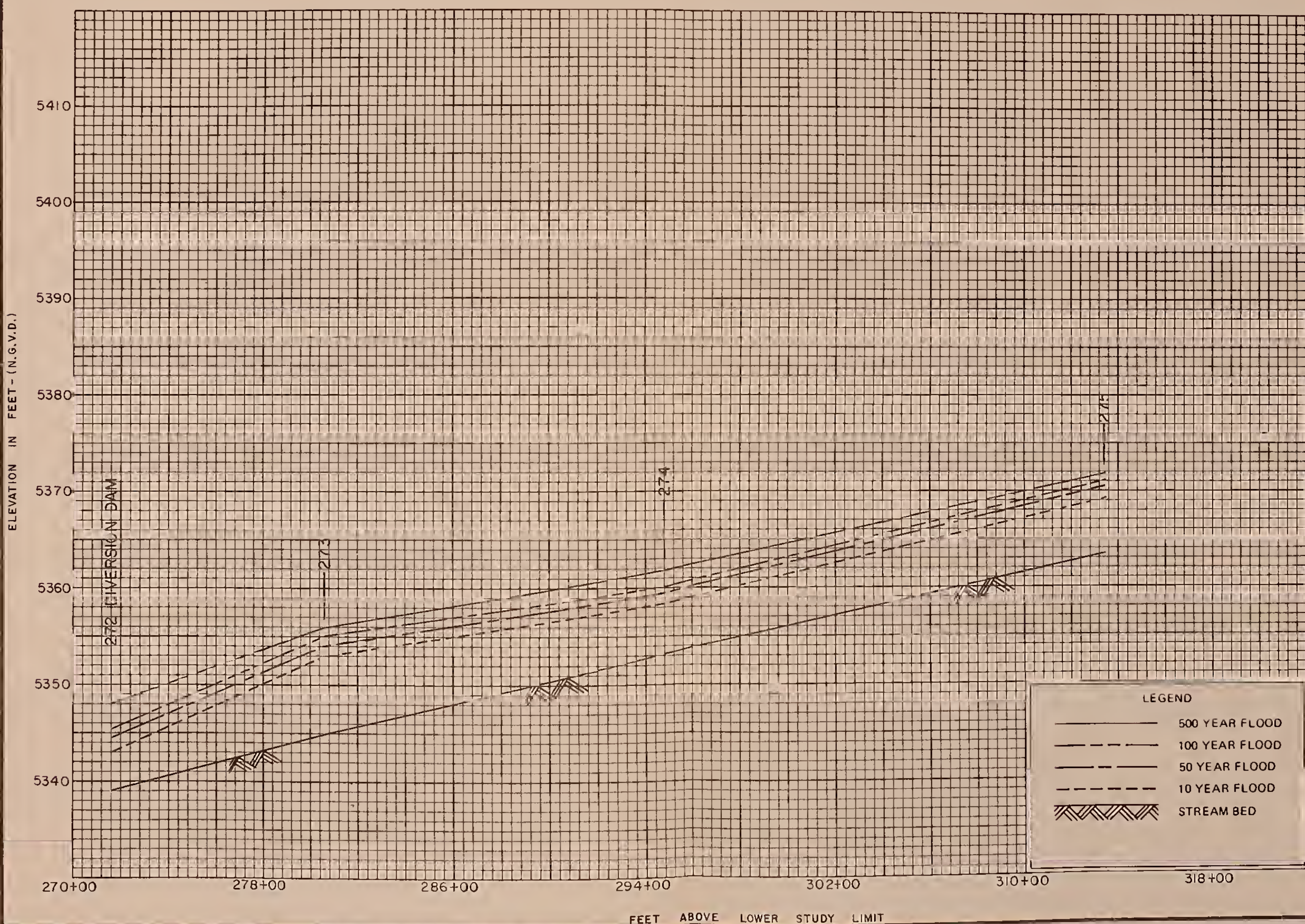
PARACHUTE CREEK AND ROAN CREEK STUDY

PARACHUTE CREEK

STA. 233+75 TO 271+65

USDA-SCS

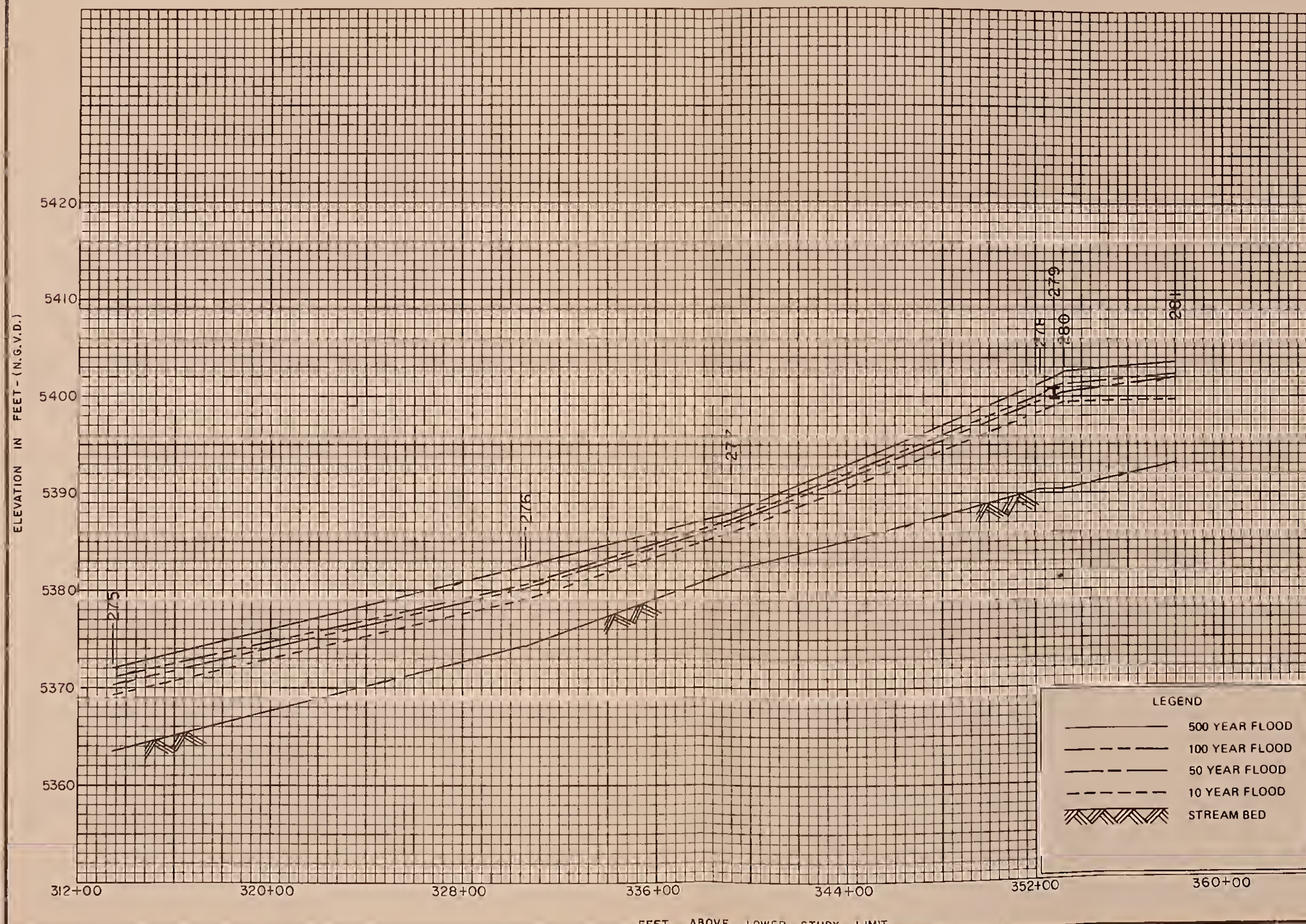
A-6



FLOOD PROFILES

PARACHUTE CREEK AND ROAN CREEK STUDY

PARACHUTE CREEK
STA. 271+65 TO 313+35
USDA-SCS



FLOOD PROFILES

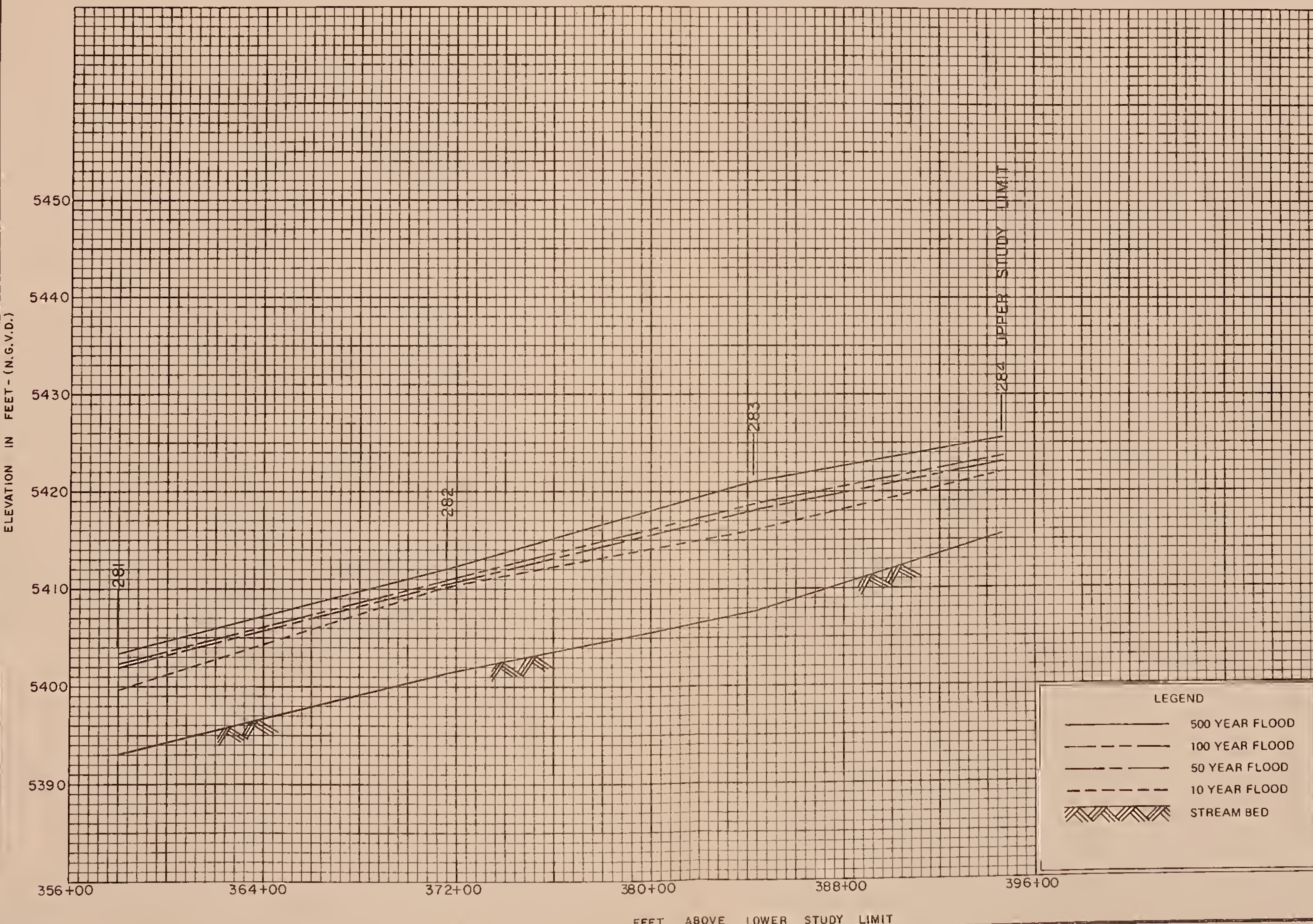
PARACHUTE CREEK AND ROAN CREEK STUDY

PARACHUTE CREEK

STA. 313+35 TO 358+05

USDA-SCS

A-8



PARACHUTE CREEK AND ROAN CREEK STUDY

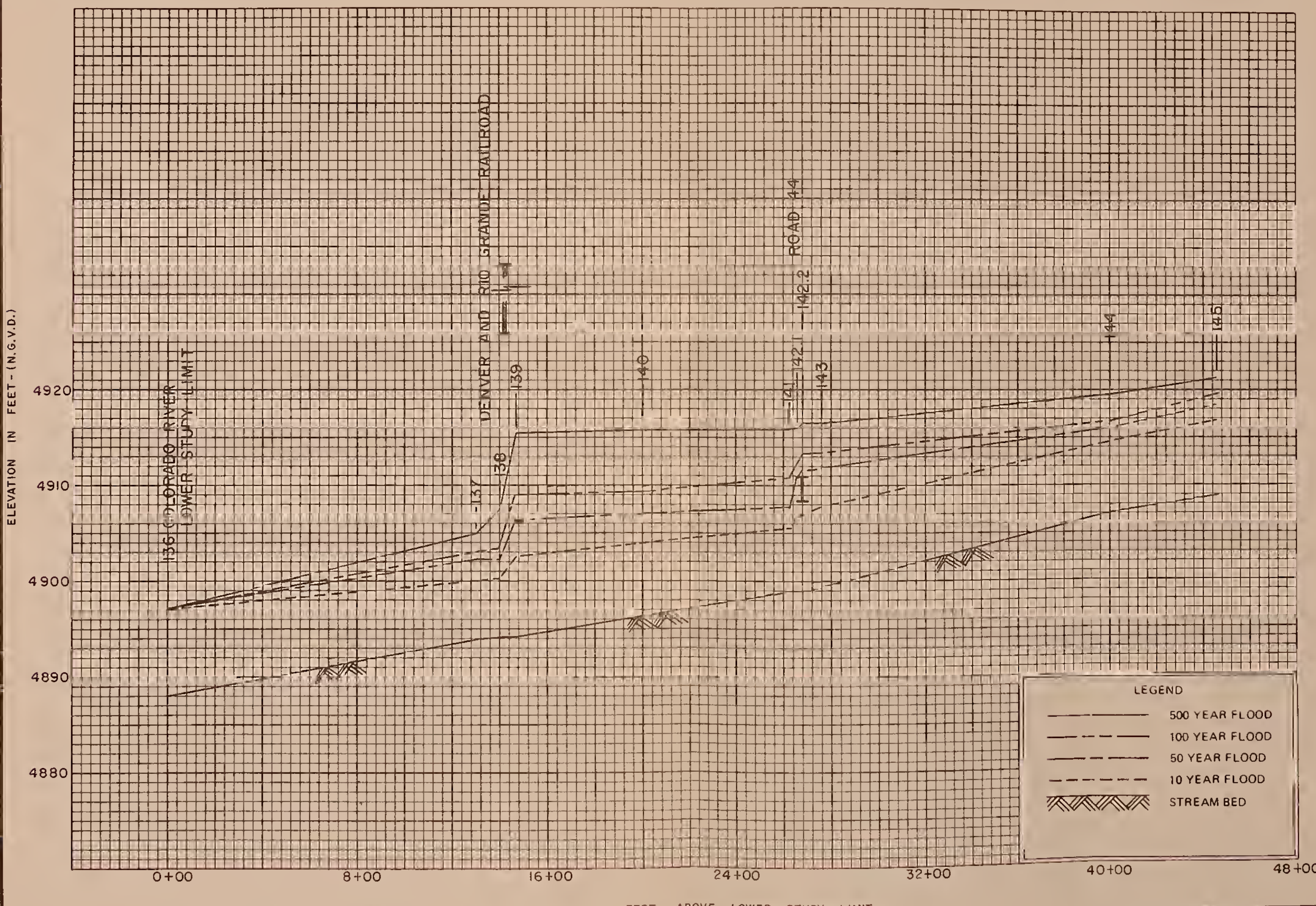
FLOOD PROFILES

PARACHUTE CREEK

STA. 358+05 TO 394+65

USDA-SCS

A-9



FLOOD PROFILES

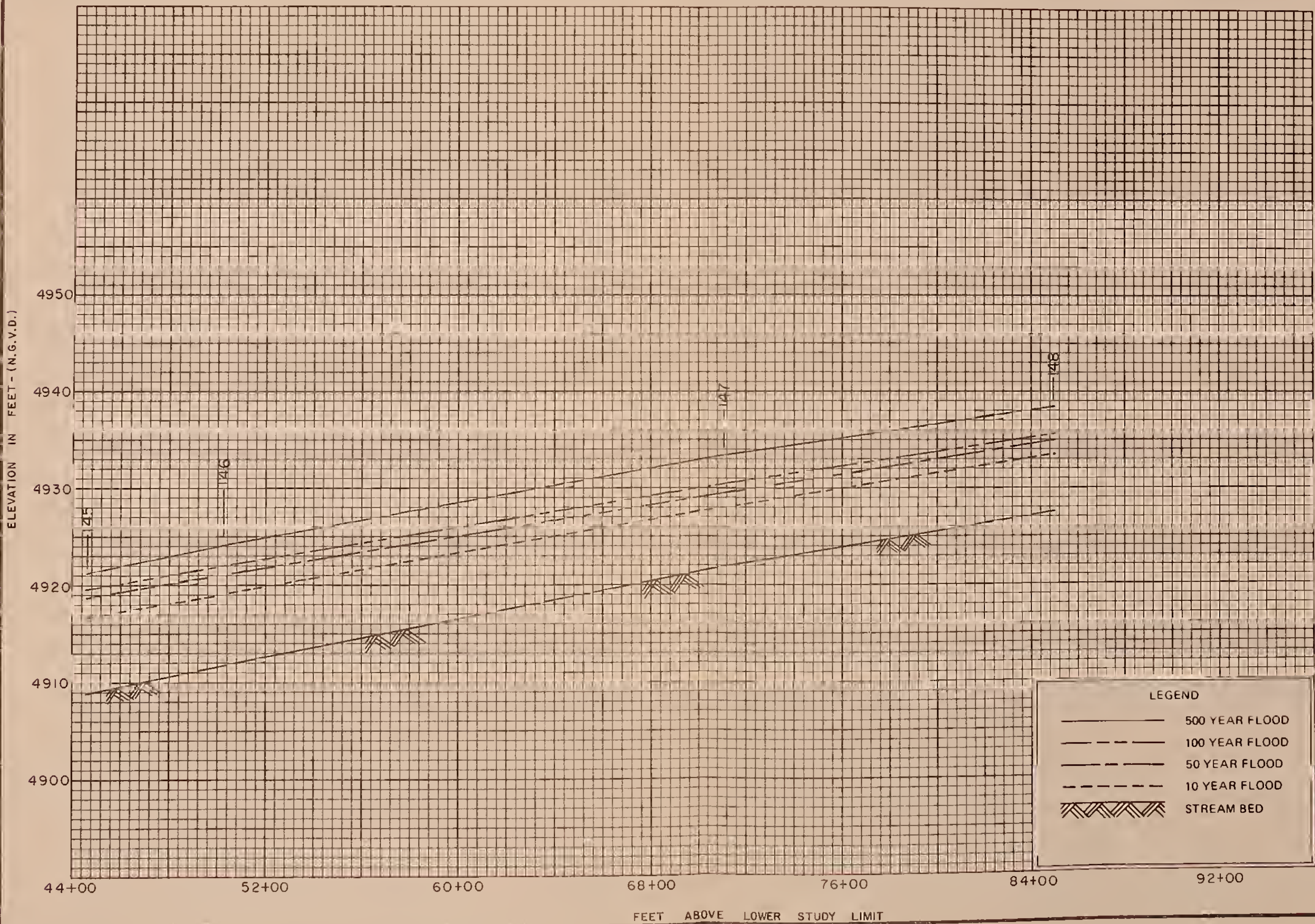
PARACHUTE CREEK AND ROAN CREEK STUDY

ROAN CREEK

STA. 0+00 TO 44+55

USDA-SCS

A-10



FLOOD PROFILES

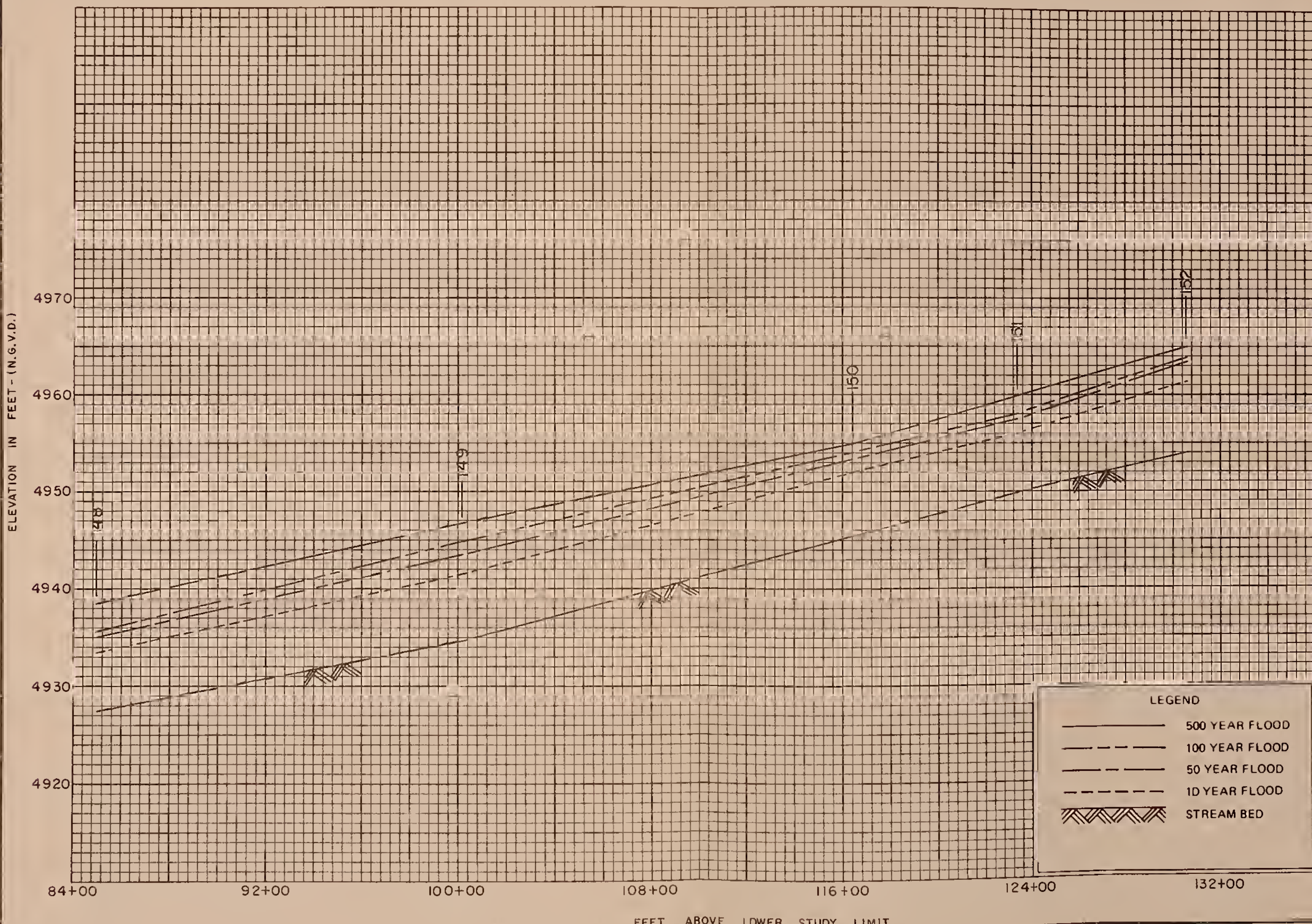
PARACHUTE CREEK AND ROAN CREEK STUDY

ROAN CREEK

STA. 44+55 TO 85+05

USDA-SCS

A-11

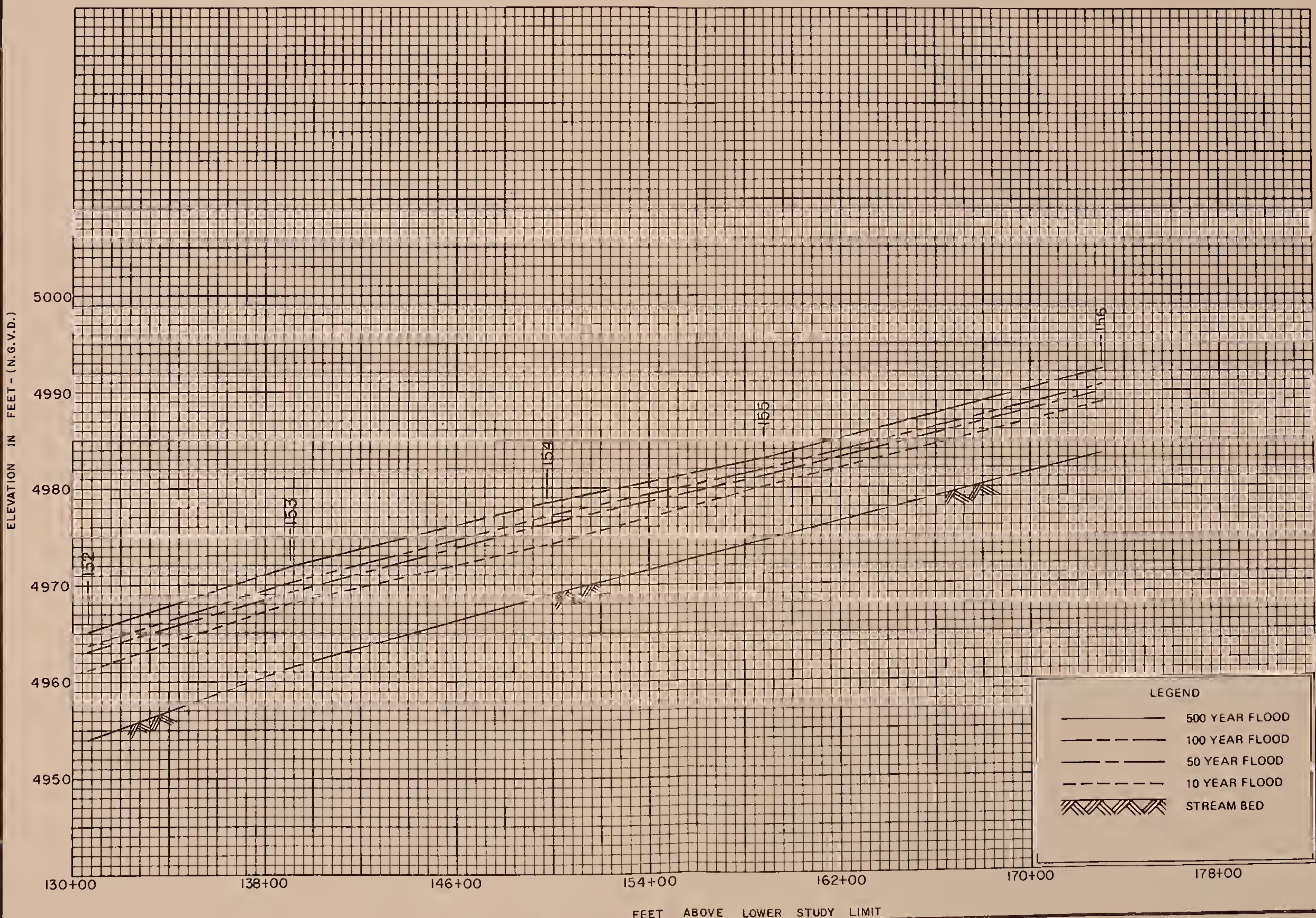


PARACHUTE CREEK AND ROAN CREEK STUDY

FLOOD PROFILES

ROAN CREEK
STA. 85+55 TO 130+55
USDA-SCS

A-12



FLOOD PROFILES

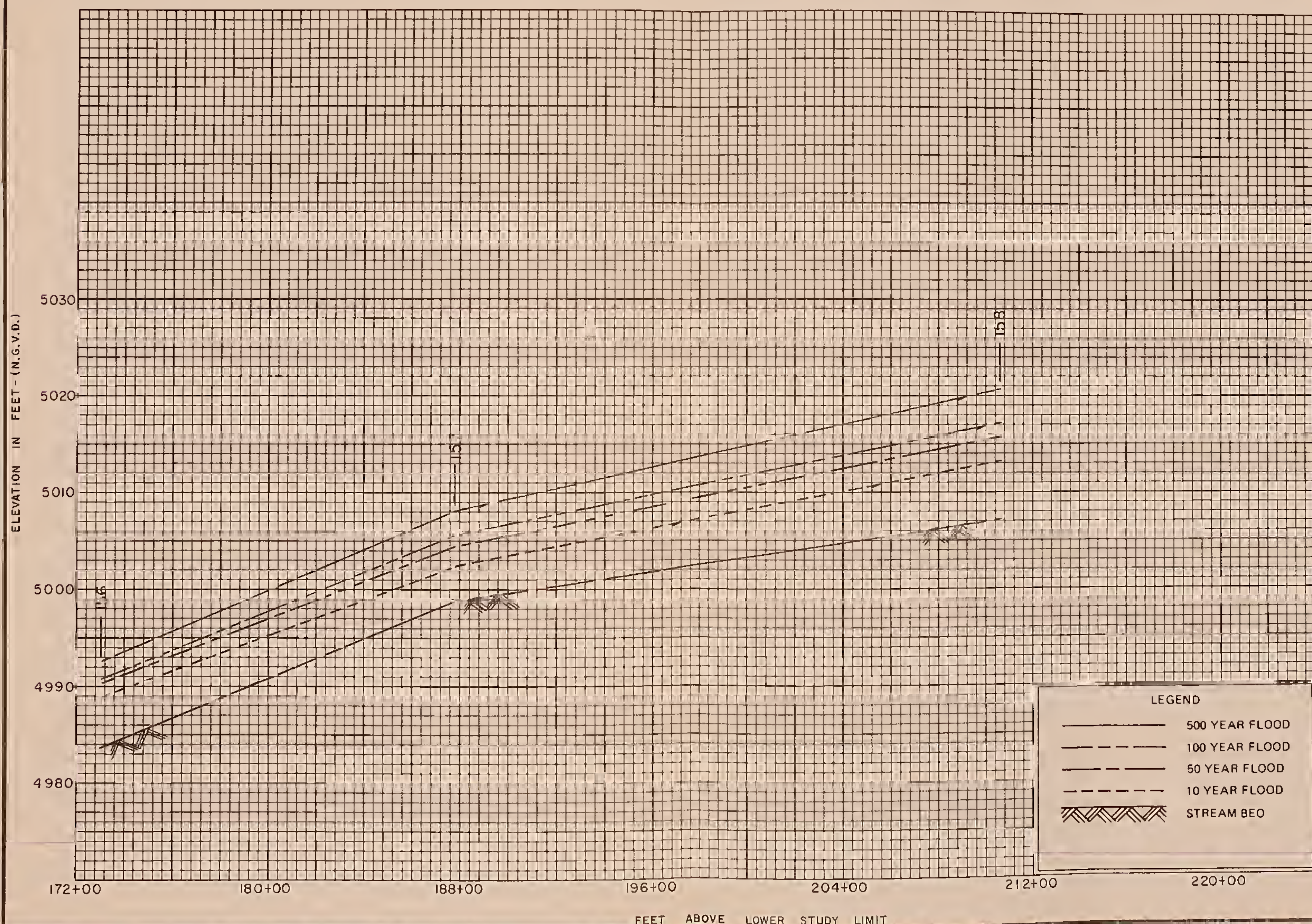
PARACHUTE CREEK AND ROAN CREEK STUDY

ROAN CREEK

STA. 130+55 TO 173+05

USDA-SCS

A-13



FLOOD PROFILES

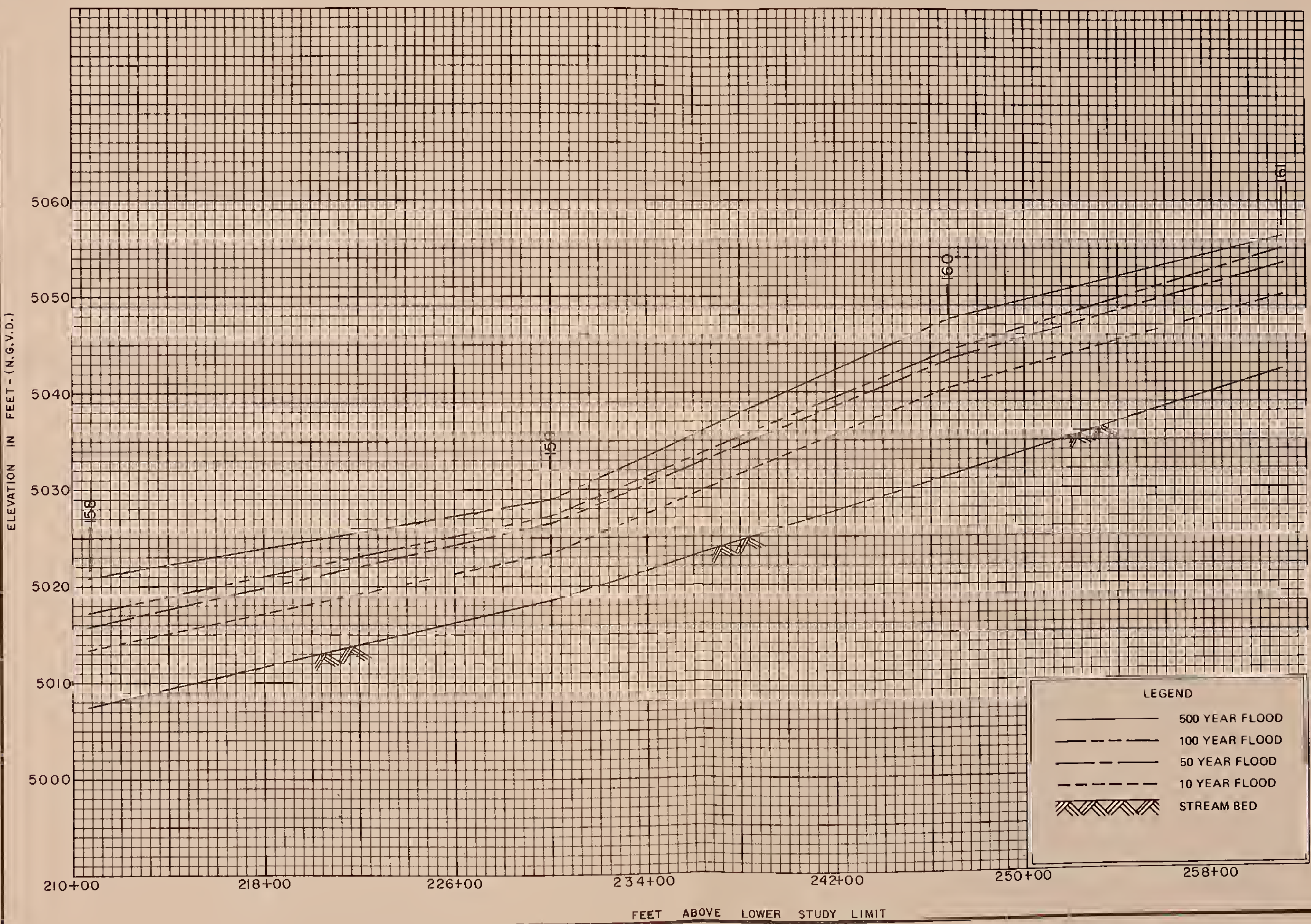
PARACHUTE CREEK AND ROAN CREEK STUDY

ROAN CREEK

STA. 173+05 TO 210+65

USDA-SCS

A-14



FLOOD PROFILES

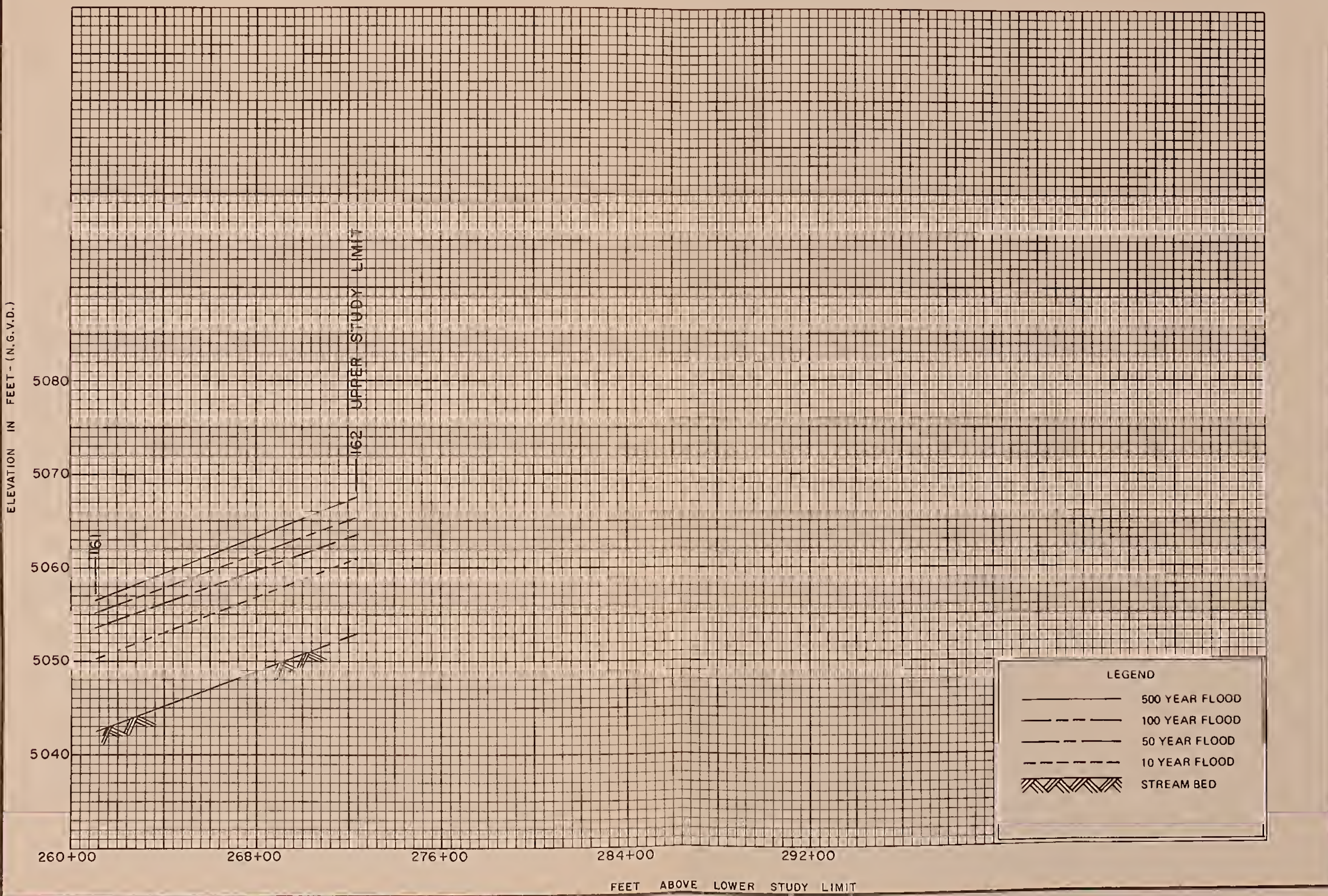
PARACHUTE CREEK AND ROAN CREEK STUDY

ROAN CREEK

STA. 210+65 TO 261+05

USDA-SCS

A-15



FLOOD PROFILES

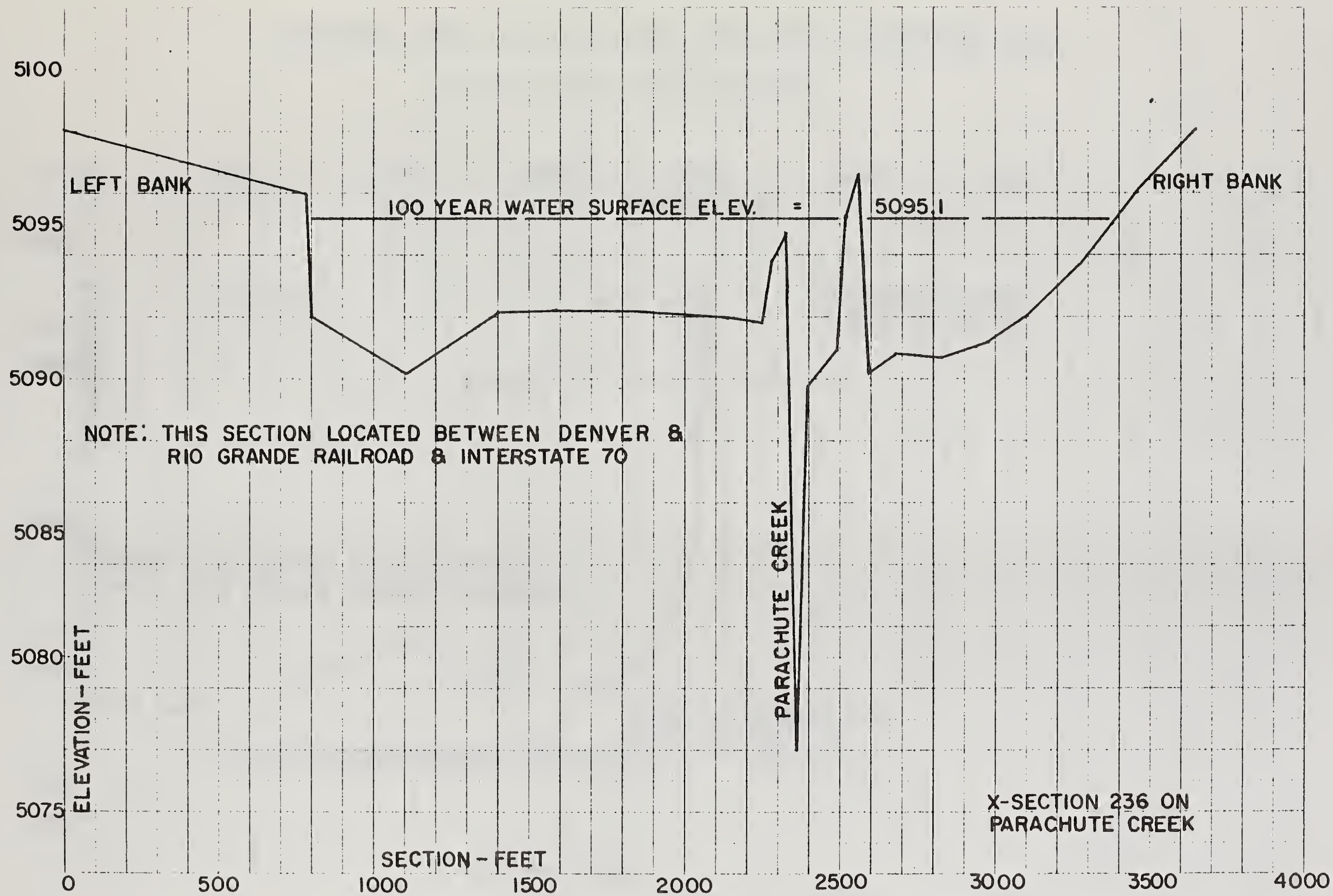
PARACHUTE CREEK AND ROAN CREEK STUDY

ROAN CREEK

STA. 261+05 TO 272+45

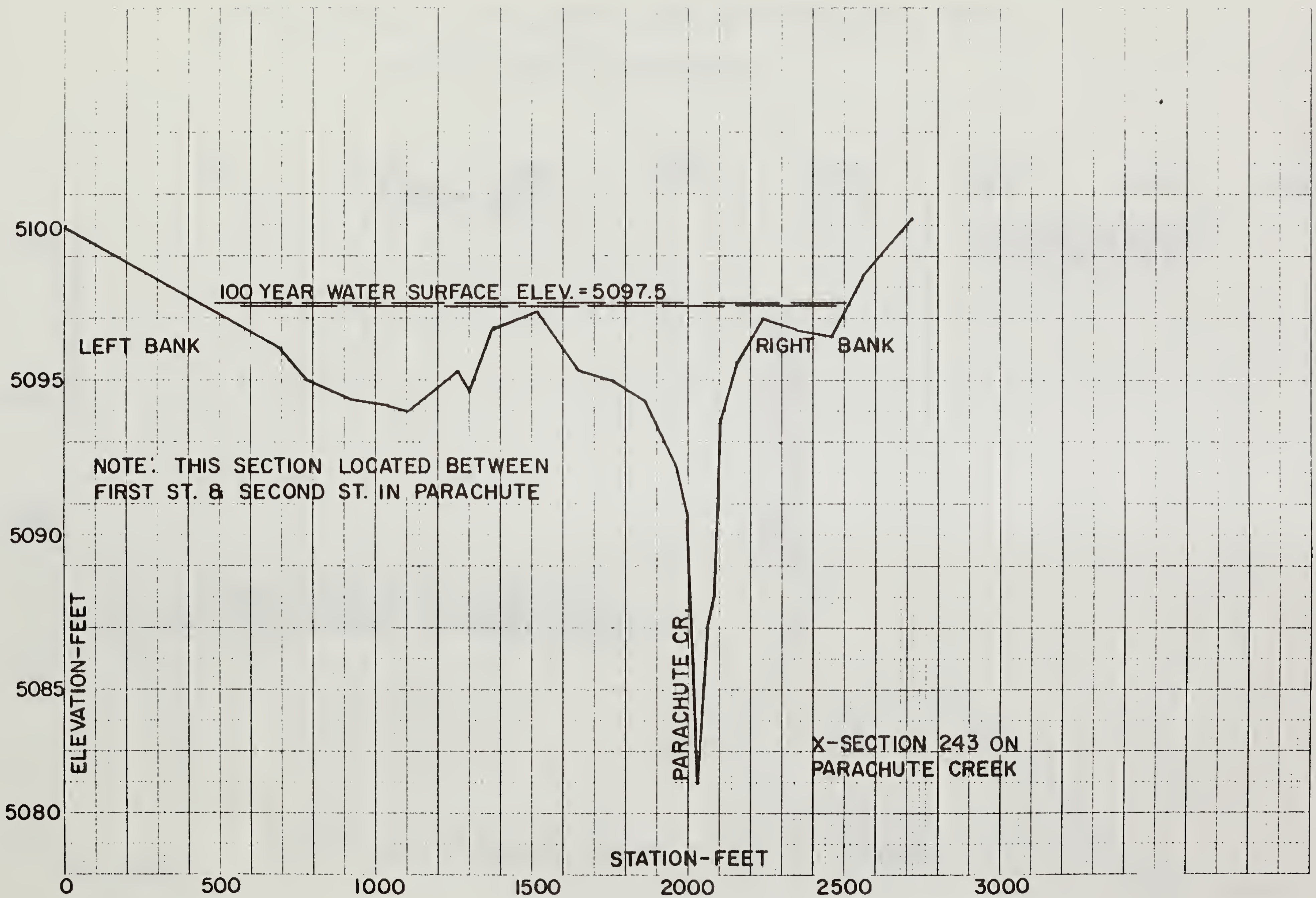
USDA-SCS

A-16



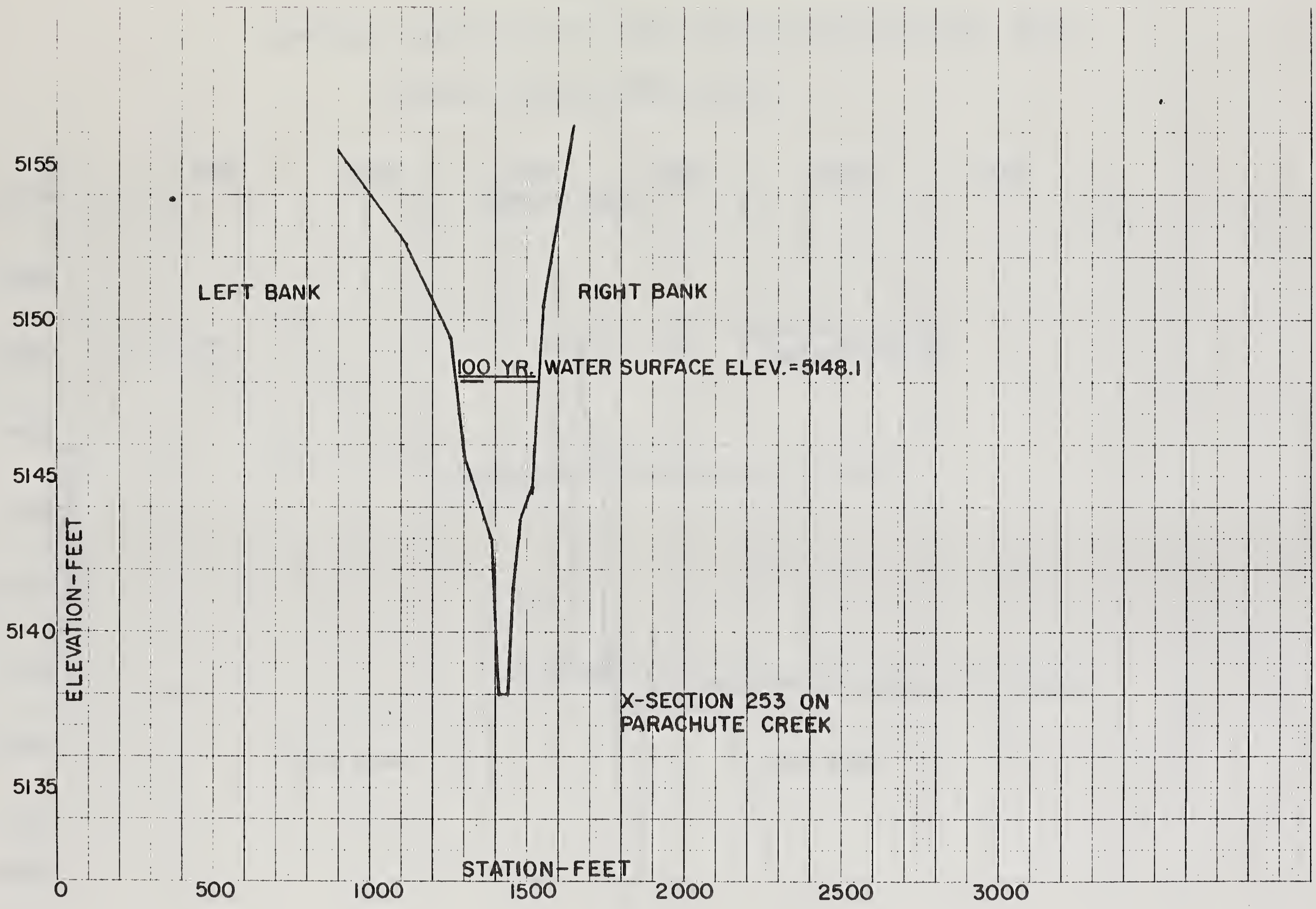
TYPICAL VALLEY CROSS-SECTION

PARACHUTE CREEK AND ROAN CREEK FLOOD PLAIN MANAGEMENT STUDY



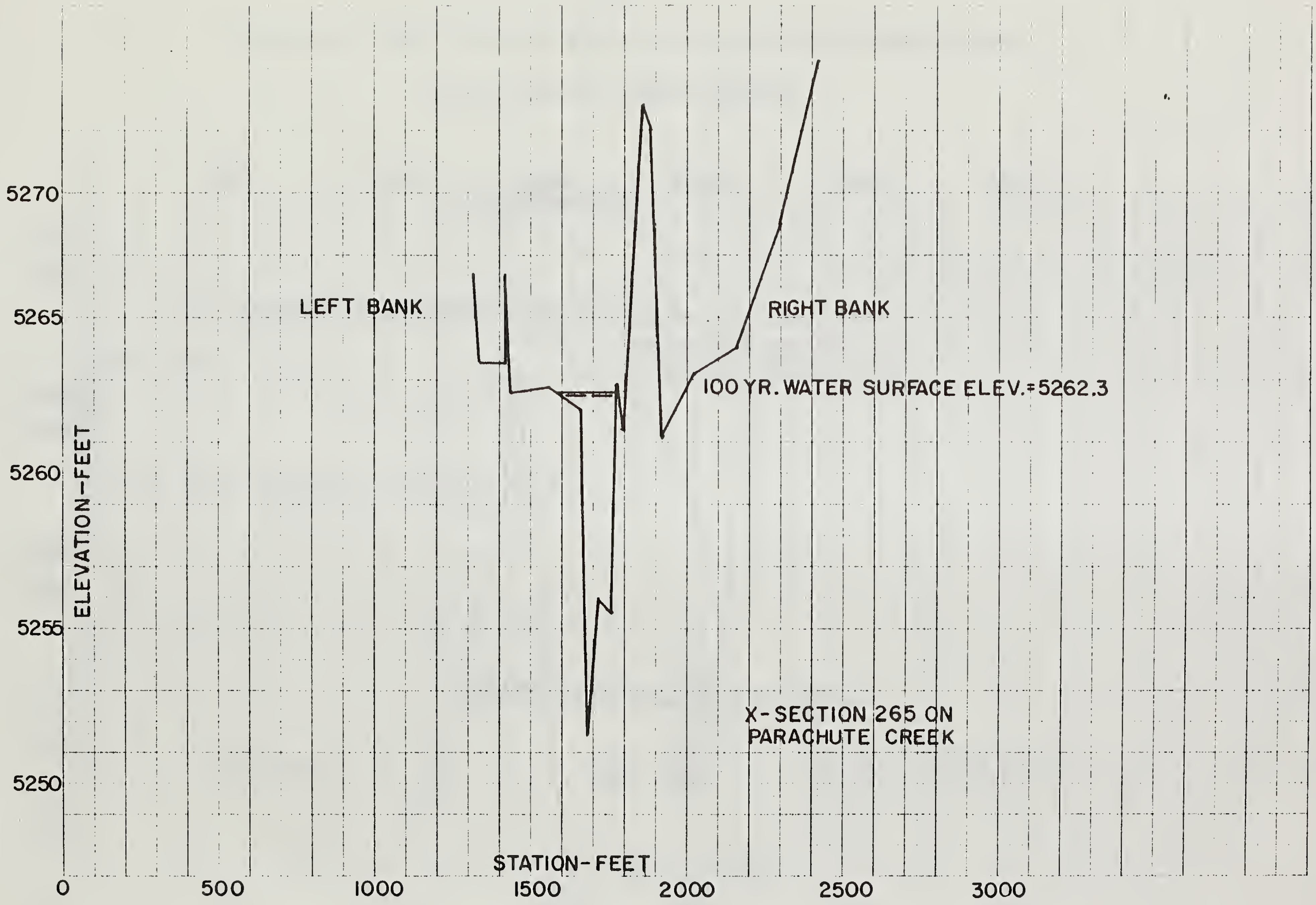
TYPICAL VALLEY CROSS-SECTION

PARACHUTE CREEK AND ROAN CREEK FLOOD PLAIN MANAGEMENT STUDY



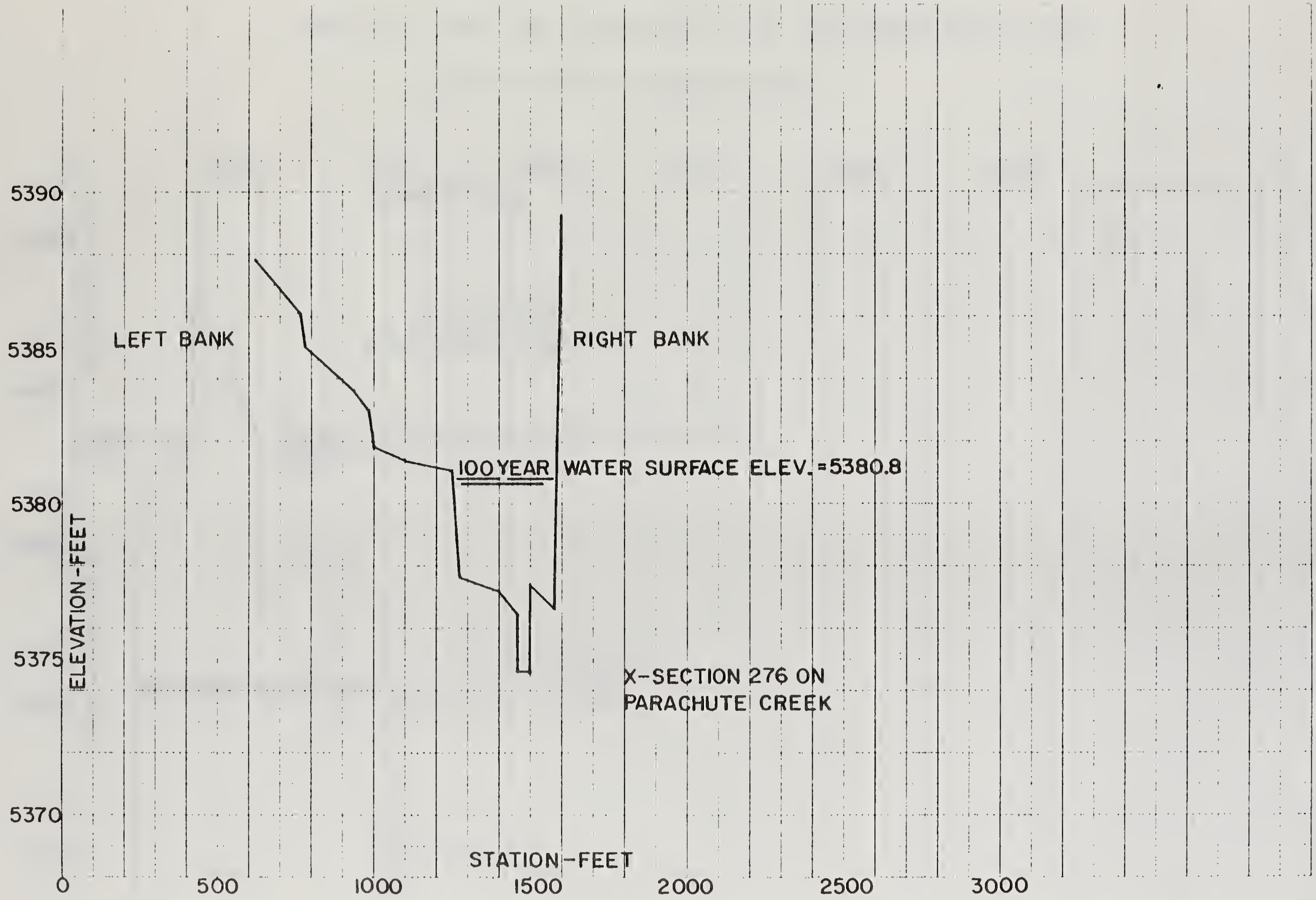
TYPICAL VALLEY CROSS-SECTION

PARACHUTE CREEK AND ROAN CREEK FLOOD PLAIN MANAGEMENT STUDY



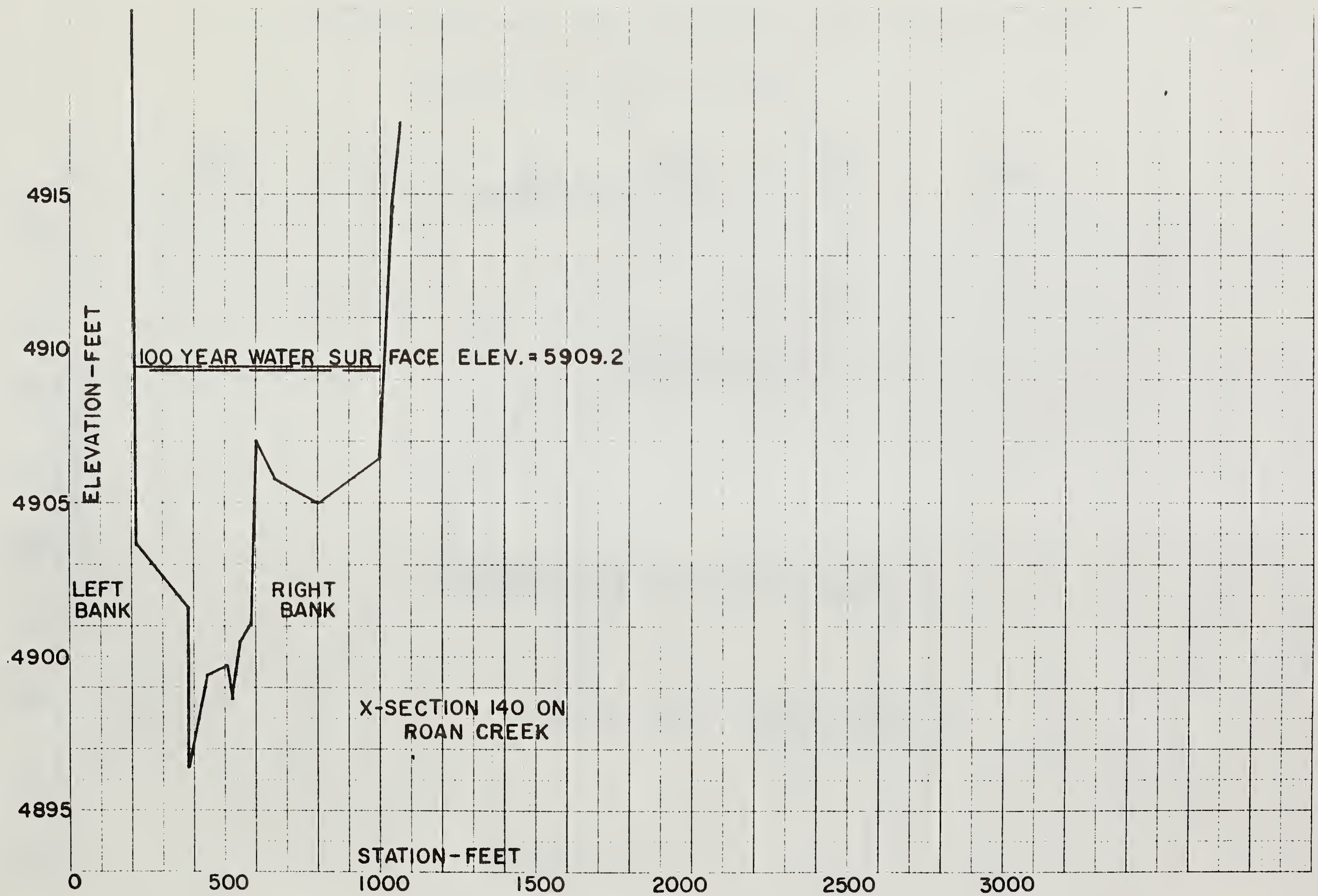
TYPICAL VALLEY CROSS-SECTION

PARACHUTE CREEK AND ROAN CREEK FLOOD PLAIN MANAGEMENT STUDY



TYPICAL VALLEY CROSS-SECTION

PARACHUTE CREEK AND ROAN CREEK FLOOD PLAIN MANAGEMENT STUDY



TYPICAL VALLEY CROSS-SECTION

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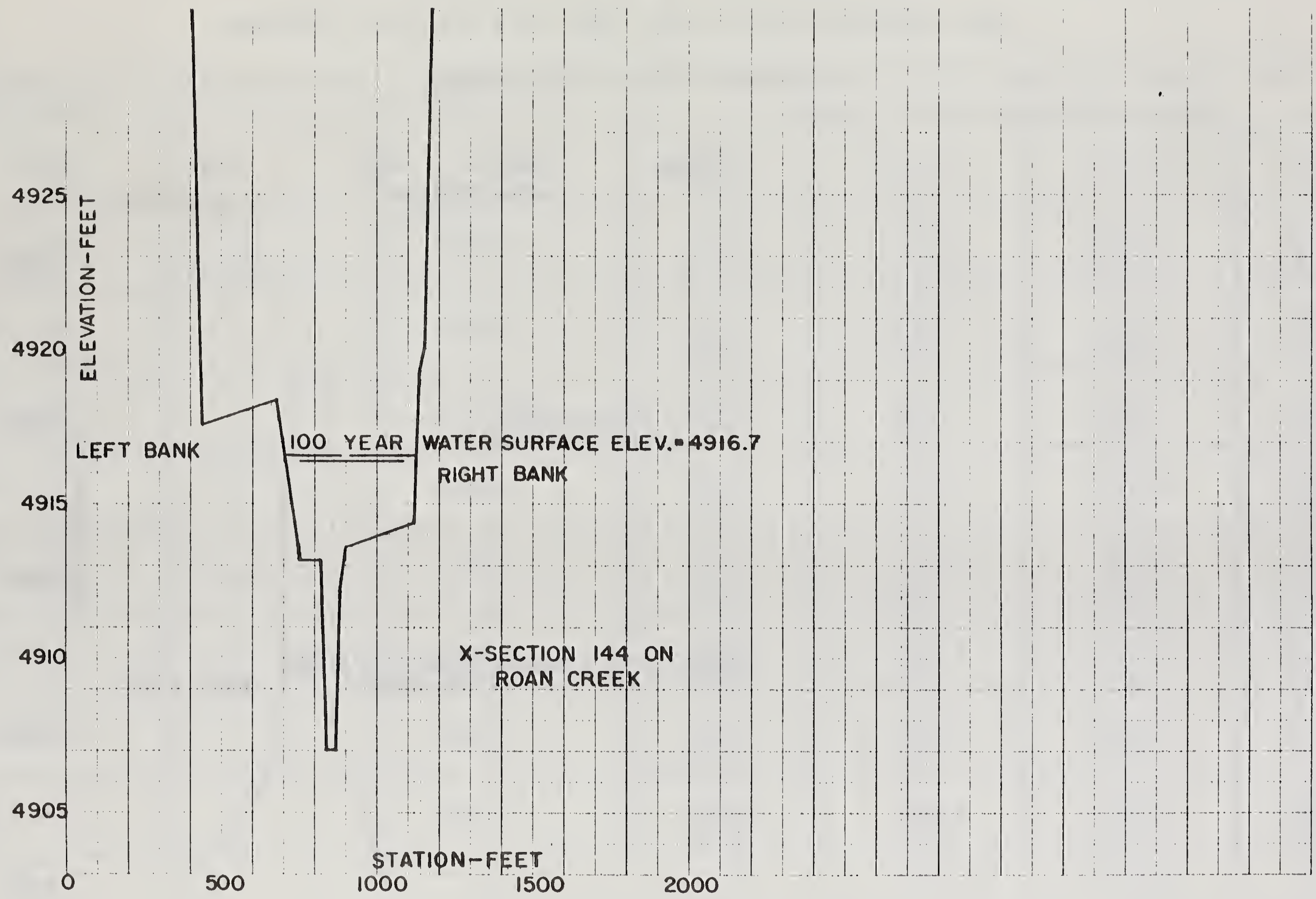

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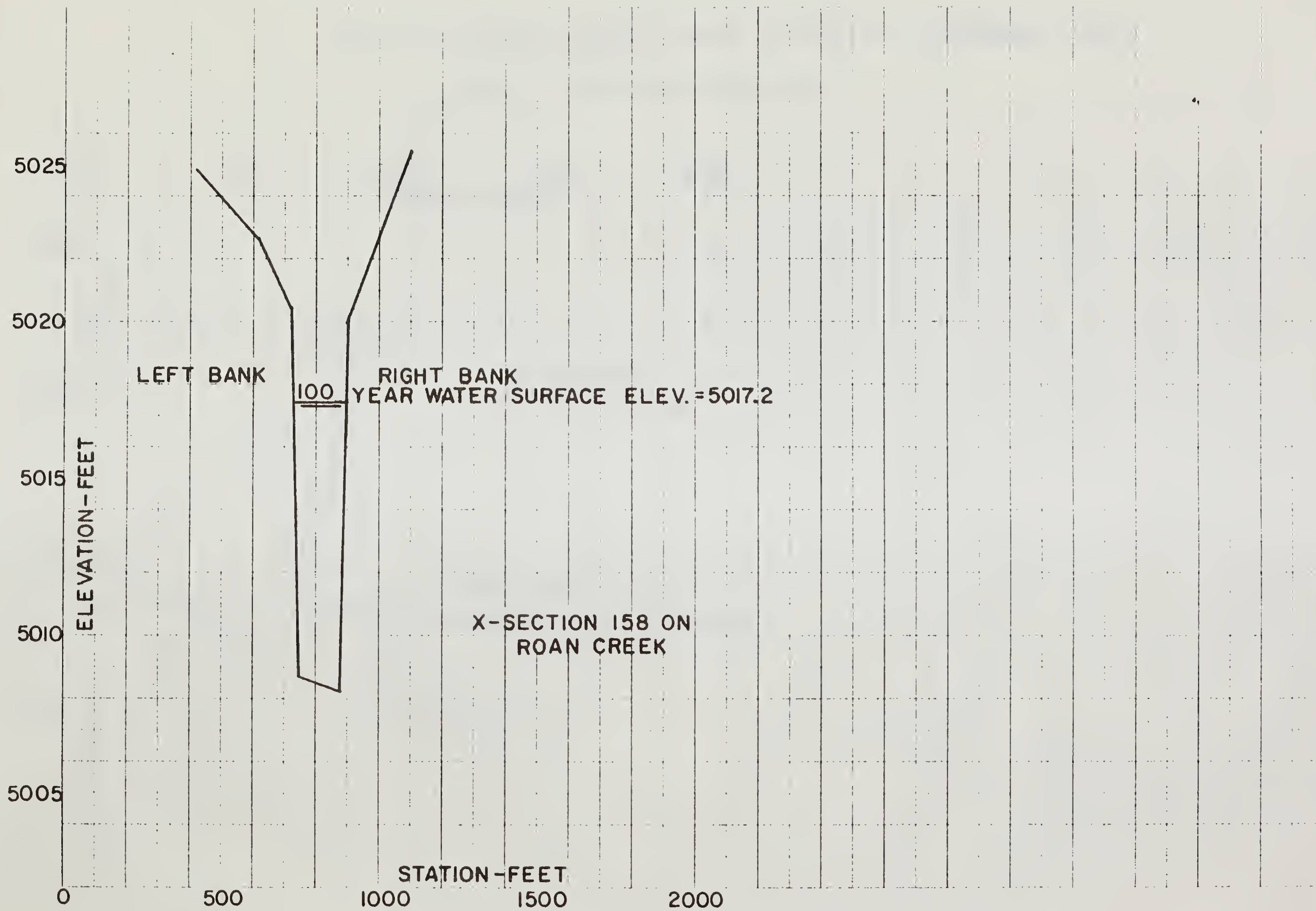

TYPICAL VALLEY CROSS-SECTION

PARACHUTE CREEK AND ROAN CREEK FLOOD PLAIN MANAGEMENT STUDY

TABLE 1

FLOOD FREQUENCY-ELEVATION AND DISCHARGE DATA 1/

Cross Section Designation	Stationing from Mouth Feet	Identification	Stream Bed Elevation Feet N.G.V.D.	Crest-Elevation Feet National Geodetic Vertical Datum, and Peak Discharge c.f.s.			
				10-Year Flood	50-Year Flood	100-Year Flood	500-Year Flood
226	0 + 00	Co. River at Parachute Cr.	5040.2	5053.8 35300 2/	5053.8 35300 2/	5053.8 35300 2/	5053.8 35300 2/
227	10 + 40		5048.6	5054.6 2350	5056.3 4250	5056.4 4400	5056.4 4400
228	21 + 60		5056.9	5063.1 2350	5064.7 4250	5064.7 4400	5064.7 4400
229	37 + 20		5065.3	5072.4 2350	5074.3 4250	5074.4 4400	5074.4 4400
230	38 + 15	County Road	5065.0	5073.9 2350	5075.7 4250	5075.8 4400	5075.8 4400
231	38 + 60		5066.2	5073.7 2350	5075.7 4250	5075.8 4400	5075.8 4400
232	41 + 40		5067.6	5075.4 2350	5077.0 4250	5077.1 4400	5077.1 4400
233	46 + 60		5074.2	5080.2 2350	5081.0 4250	5081.1 4400	5081.1 4400

1/ Flood elevations pertain to the primary channel and usually remain constant in a lateral direction across the flood plain. However, flood elevations in the outer portions of a cross section may differ from the primary channel due to road crossings, upstream diversions, etc.

2/ Dishcarge in Colorado River at 25-year frequency.

TABLE 1

FLOOD FREQUENCY-ELEVATION AND DISCHARGE DATA 1/

Cross Section Designation	Stationing from Mouth Feet	Identification	Stream Bed Elevation Feet N.G.V.D.	Crest-Elevation Feet National Geodetic Vertical Datum, and Peak Discharge c.f.s.			
				10-Year Flood	50-Year Flood	100-Year Flood	500-Year Flood
234	55 + 00		5076.7	5086.3 2350	5088.4 4250	5088.5 4400	5088.5 4400
235.1	55 + 60	Denver & Rio Grande Railroad	5076.7	5086.9 2350	5089.1 4400	5089.5 5600	5090.5 10000
235.2	55 + 80		5076.7	5088.1 2350	5094.5 4400	5095.1 5600	5096.1 10000
236	56 + 25		5077.0	5088.2 2350	5094.5 4400	5095.1 5600	5096.1 10000
237.1	57 + 10	Interstate-70 Highway	5077.0	5088.5 2350	5094.3 4400	5095.1 5600	5096.2 10000
237.2	57 + 45		5077.0	5088.5 2350	5095.1 4400	5096.3 5600	5097.4 10000
238	57 + 80		5078.6	5088.6 2350	5095.3 4400	5096.3 5600	5097.4 10000
239.1	58 + 10	Interstate-70 Highway	5078.6	5088.7 2350	5095.3 4400	5096.3 5600	5097.4 10000

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				10-Year Flood	50-Year Flood	100-Year Flood	500-Year Flood
239.2	58 + 45		5078.6	5088.7 2350	5096.3 4400	5097.3 5600	5098.4 10000
240	59 + 05		5079.6	5088.8 2350	5096.4 4400	5097.3 5600	5098.4 10000
241.1	60 + 20	First Street	5079.6	5089.4 2350	5096.4 4400	5097.3 5600	5098.4 10000
241.2	60 + 55		5079.6	5089.4 2350	5096.5 4400	5097.4 5600	5098.6 10000
242	60 + 65		5080.3	5089.4 2350	5096.5 4400	5097.4 5600	5098.6 10000
243	62 + 30		5081.1	5091.0 2350	5096.6 4400	5097.5 5600	5098.6 10000
244	68 + 70		5085.5	5095.8 2350	5097.1 4400	5097.8 5600	5099.1 10000
245	75 + 25		5091.3	5100.4 2350	5102.3 4400	5102.8 5600	5103.9 10000

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Cross Section Designation	Stationing from Mouth	Identification	Stream Bed Elevation	Crest-Elevation Feet National Geodetic Vertical Datum, and Peak Discharge c.f.s.			
	Feet		Feet N.G.V.D.	10-Year Flood	50-Year Flood	100-Year Flood	500-Year Flood
246	85 + 25		5102.6	5108.6 2350	5109.6 4400	5110.4 5600	5112.0 10000
247	91 + 05		5105.6	5113.3 2350	5115.0 4400	5115.5 5600	5116.8 10000
248	99 + 75		5112.5	5118.9 2350	5121.1 4400	5122.2 5600	5126.7 10000
249	111 + 55		5127.7	5134.4 2350	5136.2 4400	5137.0 5600	5139.2 10000
250	120 + 35		5132.4	5140.4 2350	5142.3 4400	5143.2 5600	5144.9 10000
251.1	120 + 50	Private Road	5132.4	5140.5 2350	5142.4 4400	5143.3 5600	5145.8 10000
251.2	120 + 65		5132.4	5143.0 2350	5144.5 4400	5145.0 5600	5146.3 10000
252	121 + 05		5132.4	5142.8 2350	5144.5 4400	5145.0 5600	5146.5 10000

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	Feet		Feet N.G.V.D.	10-Year Flood	50-Year Flood	100-Year Flood	500-Year Flood
253	127 + 05		5138.0	5145.2 2350	5147.2 4400	5148.1 5600	5149.6 10000
254	139 + 05		5151.8	5156.7 2350	5157.6 4400	5157.9 5600	5159.2 10000
255	148 + 85		5162.0	5167.3 2350	5169.7 4400	5170.7 5600	5174.4 10000
256	166 + 35		5180.4	5187.3 2350	5189.3 4400	5190.2 5600	5193.1 10000
257	180 + 15		5196.8	5202.5 2350	5205.0 4400	5206.1 5600	5208.1 10000
258	186 + 95		5208.6	5213.3 2350	5214.6 4400	5215.3 5600	5217.8 10000
259	188 + 15	Diversion Dam	5215.3	5218.7 2350	5219.5 4400	5219.9 5600	5220.8 10000
260	195 + 35		5219.6	5225.3 2350	5226.6 4400	5227.1 5600	5228.8 10000

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Cross Section Design-nation	Stationing from Mouth	Identification	Stream Bed Elevation	Crest-Elevation Feet National Geodetic Vertical Datum, and Peak Discharge c.f.s.			
	Feet		Feet N.G.V.D.	10-Year Flood	50-Year Flood	100-Year Flood	500-Year Flood
261	195 + 65	County Road	5220.0	5229.1 2350	5230.8 4400	5231.3 5600	5232.3 10000
262	196 + 45		5220.8	5230.9 2350	5232.1 4400	5232.4 5600	5233.7 10000
263	199 + 55		5223.0	5231.1 2350	5232.2 4400	5232.5 5600	5235.6 10000
264	209 + 15		5233.7	5240.1 2200	5243.5 4200	5245.4 5300	5247.3 9400
265	224 + 05		5252.5	5259.7 2200	5261.6 4200	5262.3 5300	5264.9 9400
266	232 + 85		5262.8	5269.1 2200	5272.7 4200	5273.5 5300	5276.0 9400
267	233 + 05	Union Oil Road	5263.0	5270.9 2200	5275.3 4200	5275.6 5300	5276.5 9400
268	233 + 75		5263.4	5276.0 2200	5276.4 4200	5276.8 5300	5277.8 9400

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Cross Section Designation	Stationing from Mouth Feet	Identification	Stream Bed Elevation Feet N.G.V.D.	Crest-Elevation Feet National Geodetic Vertical Datum, and Peak Discharge c.f.s.			
				10-Year Flood	50-Year Flood	100-Year Flood	500-Year Flood
269	244 + 15		5277.3	5283.2 2200	5285.3 4200	5286.4 5300	5288.2 9400
270	255 + 25		5299.5	5305.6 2200	5306.7 4200	5307.2 5300	5308.6 9400
271	260 + 75		5308.6	5314.4 2200	5316.2 4200	5317.4 5300	5319.1 9400
272	271 + 65	Diversion Dam	5339.1	5343.1 2200	5344.6 4200	5345.3 5300	5348.1 9400
273	280 + 65		5346.0	5353.2 2200	5354.4 4200	5355.0 5300	5356.1 9400
274	294 + 75		5353.3	5358.8 2200	5359.7 4200	5360.2 5300	5361.8 9400
275	313 + 35		5363.7	5369.4 2200	5370.6 4200	5371.1 5300	5372.2 9400
276	330 + 55		5374.6	5379.2 2200	5380.3 4200	5380.8 5300	5382.3 9400

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				10-Year Flood	50-Year Flood	100-Year Flood	500-Year Flood
277	339 + 15		5382.0	5386.0 2200	5386.8 4200	5387.2 5300	5388.0 9400
278	352 + 15		5390.3	5398.6 2200	5399.8 4200	5400.2 5300	5401.5 9400
279.1	352 + 30	Railroad & County Road	5390.3	5398.6 2200	5399.9 4200	5400.4 5300	5401.9 9400
279.2	352 + 75		5390.3	5398.6 2200	5401.5 4200	5401.6 5300	5402.6 9400
280	353 + 25		5390.6	5399.4 2200	5401.7 4200	5401.8 5300	5402.9 9400
281	358 + 05		5393.0	5399.8 2200	5402.0 4200	5402.1 5300	5403.7 9400
282	371 + 65		5401.5	5410.3 2200	5410.5 4200	5410.8 5300	5412.1 9400
283	384 + 25		5407.6	5415.9 2200	5418.1 4200	5418.8 5300	5421.0 9400

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Cross Section Design-nation	Stationing from Mouth	Identification	Stream Bed Elevation	Crest-Elevation Feet National Geodetic Vertical Datum, and Peak Discharge c.f.s.			
	Feet		Feet N.G.V.D.	10-Year Flood	50-Year Flood	100-Year Flood	500-Year Flood
284	394 + 65	Upper Study Limit on Parachute Cr.	5415.6	5422.0 2200	5422.9 4200	5423.5 5300	5425.6 9400

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				10-Year Flood	50-Year Flood	100-Year Flood	500-Year Flood
136	0 + 00	Co. River at Roan Cr.	4888.3	4897.1 37000 2/	4897.1 37000 2/	4897.1 37000 2/	4897.1 37000 2/
137	13 + 00		4893.9	4900.2 3650	4902.3 7400	4903.0 9700	4904.9 17500
138	13 + 90	Denver & Rio Grande Railroad	4894.3	4901.5 3650	4902.4 7400	4903.5 9700	4907.6 17500
139	14 + 55		4894.1	4902.7 3650	4906.5 7400	4908.9 9700	4915.7 17500
140	20 + 05		4896.4	4903.5 3650	4906.9 7400	4909.2 9700	4915.9 17500
141	26 + 25		4898.8	4905.3 3605	4907.9 7400	4910.8 9700	4915.9 17500
142.1	26 + 65	44 Road	4898.8	4906.7 3650	4910.4 7400	4912.3 9700	4916.0 17500
142.2	26 + 85		4898.8	4906.8 3650	4911.7 7400	4913.4 9700	4916.7 17500

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2/ Discharge in Colorado River at 25-year frequency.

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Cross Section Designation	Stationing from Mouth Feet	Identification	Stream Bed Elevation Feet N.G.V.D.	Crest-Elevation Feet National Geodetic Vertical Datum, and Peak Discharge c.f.s.			
				10-Year Flood	50-Year Flood	100-Year Flood	500-Year Flood
143	27 + 55		4899.2	4907.8 3650	4911.8 7400	4913.4 9700	4916.7 17500
144	39 + 95		4907.0	4914.7 3650	4916.0 7400	4916.7 9700	4919.3 17500
145	44 + 55		4908.9	4916.9 3650	4918.8 7400	4919.5 9700	4921.2 17500
146	50 + 25		4911.9	4919.1 3650	4921.1 7400	4922.0 9700	4924.1 17500
147	71 + 05		4921.9	4928.0 3650	4929.7 7400	4930.6 9700	4933.4 17500
148	85 + 05		4927.5	4933.7 3650	4935.0 7400	4935.6 9700	4938.6 17500
149	100 + 25		4934.8	4941.3 3650	4943.7 7400	4944.9 9700	4946.9 17500
150	116 + 45		4945.7	4952.0 3650	4953.4 7400	4954.1 9700	4955.1 17500

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				10-Year Flood	50-Year Flood	100-Year Flood	500-Year Flood
151	123 + 45		4949.9	4956.1 3650	4957.6 7400	4958.1 9700	4960.0 17500
152	130 + 55		4954.1	4961.4 3650	4963.4 7400	4963.9 9700	4965.2 17500
153	139 + 05		4961.3	4968.1 3650	4969.5 7400	4970.2 9700	4972.1 17500
154	149 + 85		4968.9	4974.2 3650	4976.2 7400	4976.9 9700	4978.6 17500
155	158 + 85		4974.5	4980.2 3650	4981.2 7400	4981.8 9700	4983.2 17500
156	173 + 05		4983.6	4988.9 3650	4990.2 7400	4990.7 9700	4992.4 17500
157	187 + 85		4998.8	5002.4 3650	5004.4 7400	5005.5 9700	5008.0 17500
158	210 + 65		5007.3	5013.3 3650	5015.9 7400	5017.2 9700	5020.9 17500

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	Feet		Feet N.G.V.D.	10-Year Flood	50-Year Flood	100-Year Flood	500-Year Flood
159	230 + 05		5018.5	5023.7 3650	5026.3 7400	5027.2 9700	5029.1 17500
160	246 + 85		5031.3	5040.3 3650	5043.2 7400	5044.2 9700	5047.7 17500
161	261 + 05		5042.7	5050.2 3650	5053.8 7400	5055.1 9700	5056.6 17500
162	272 + 45	Upper Study Limit on Roan Cr.	5053.3	5061.0 3650	5063.8 7400	5065.3 9700	5067.5 17500

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SOIL CONSERVATION SERVICE